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Prey and Predator
Corbett National Park

Photo : Narendra Singh



"If you depict a forestscape without a rivulet flowing in the middle, it will be an incomplete expression of the bounty of forests. The most precious gift of forest is water and water is the life giving element which has spiritual and rejuvenating power."

- I.S. Negi

Tree Glory

The man planting tree by the wayside will enjoy bliss in heaven for as many years as there are fruits and flowers and leaves in what he planted.

'Padma Puran'

Forest is an organization of unlimited kindness that makes no demand for its sustenance but extends protection to all beings, offering shade even to the axeman who destroys it.

'Budha'

But the glory of trees is more than their gifts,
It is beautiful wonder of line that lifts;
From a wrinkled seed in an earthbound clod.
A column, an arch in the temple of God;
A pillar of power, a dome of delight,
A shrine of song, and a joy of sight;
Their roots are nurses of rivers in birth,
Their leaves are alive with the breath of the earth,
They shelter the dwellings of man; and they bend
Over his grave with look of a loving friend.

'Henry Van Dyke'

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The Need of Forests and Nature Reserves*

By

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A substantial forest is an imperative feature of a country's economy. A single glance of the luxuriant vegetation involuntarily provokes the sensation of prosperity. In early days when man led some sort of communal life, the vast forest, that had its essential uses, was considered a nuisance. It concealed his human and other enemies. It had good soil to raise his crops. His cattle herds often strayed and disappeared in the jungle. Therefore, by axe and fire he felled and cleared the jungle and grew his crops. When the soil became barren he cut and cleared a new piece of jungle and started again. This wasteful practice of shifting cultivation still prevails in some countries. At that early stage, with a small population it did not matter. The forest was vast and lasting. There was enough land and timber for all to meet their simple domestic needs. But after the two great world wars of 1914-1918 and 1939-1946 with the rapid rise of population and a high standard of life the demand for land for food cultivation, river valley projects, rehabilitation of displaced persons in forest areas and setting up big industrial projects by removal of forests, the need for more timber for house and ship building and huge quantities of fuel and charcoal all combined together created an imbalance in land use. Many countries including India wasted their natural resources, cut the verdant forest and woefully wasted vast timber resources, overgrazed pastures, pillaged wild life, tore the cover from the fertile soil, speeded up the rate of soil erosion, caused weather to be more inclement and floods to take a heavy toll of men, homesteads, cattle and soils and destroyed nature. Travel by land and air shows the barrenness of much of the hilly and upland country and the sparseness of the vegetation where it still clings under conditions of maltreatment.

* Reproduced from 'Cheetal' Vol. VIII, April 1966.

To-day due to the technological advances in using wood on a large scale in new forms, such as sawn sizes, plywood, pencils, fibre board, particle board and cartons, the growing demand for pulp and paper, due to large circulation of news papers, magazines and books and the allied development of new machines and high labour costs many countries are planning their industrial and domestic future and how to conserve their timber supplies or increase a relation to the known potential world availability. The working plans have got to look decades ahead and estimate with the changes in demand for they affect the forest management vitally.

Forests are necessary to keep up a steady and well-balanced rural employment and with this in view they are to be managed as an economic productive industry. At times of a war, especially nuclear war, causing wholesale destruction of towns and cities, there will be a tremendous demand for timber for shoring up, bridging, telecommunication, temporary buildings and furniture or even for fuel. A sustained forest industry with not only the raw materials available but also the skilled men and the haulage tackle to convey those materials into the devastated area would be very valuable.

To develop the forest resources, of late, there is the demand to change the system of forestry. One school of silviculture favours uneven-aged forests of mixed species, with as much reliance as possible on natural regeneration and a second school of silviculture prefers even-aged forests, with a single main tree species (monoculture) in each major block or unit and the use of clear felling and replanting as a normal technique. The advocates of mixed uneven-aged forests do claim much advantage in soil protection, improvement and use, and lesser risks from pests, wind and rain damages. The advocates of pure even-aged forests assert that if species are used only in suitable climates and on suitable sites and provided adequate attention is bestowed to soil maintenance and its fertility and precautions against pests, fire, wind and rain damages, the advantages of uniformity in the material produced in simple and cheaper management and harvested by recourse to mechanization to avoid costly labour, in the use of seed of superior strains and exotic species both broad-leaved and certain conifers far outweigh any disadvantages and dangers. Any way, there happens to be a striking change in the aims of forestry and silviculture. Techniques of raising woods of fast

growing species, forest management, new planting programmes and creation of even-aged stands are being standardised in many countries. Experience of afforestation on grassland and degraded and eroded forest areas has shown that it can be done best by modification of site and use of exotic species. It is essential, at the outset to determine the environmental factors and their changes in relation to different species as accurately and specifically as possible as new forests develop, to ensure that the stresses between environment and forests do not develop unduly in trying to achieve the desired objects.

The area under forests in India is 302,688 sq. miles constituting only 24% of the total geographical area of 1,259,982 sq. miles. The per capita forest area is only 0.54 acre. The National Forest Policy (1952) lays down that "India as a whole should aim at maintaining one-third of its land under forests". Recently, the lands potentially fit for the purpose are added to the existing forest areas so as to make up for the deficiency. Many forest areas are brought under the Working Plans.

Under the Five-Year Plans in India huge planting schemes and schemes of rehabilitation of degraded forests and of afforesting waste, gullied, ravined or otherwise ruined lands are in hand to meet the very great needs for wood and pulps of all kinds. Some of the great and valuable natural forests containing Teak, *Pterocarpus marsupium*, *Dalbergia latifolia*, *Terminalias*, *Dipterocarpaceae*, etc., predominantly are also being conserved and improved and supplemented by planting. The silvicultural systems adopted vary from selection to clearfelling and planting. A great stride is taken to grow fast growing trees such as Eucalyptus, Poplars and some Conifers, besides the traditionally slow growing indigenous species such as Teak, *Dalbergia latifolia* and soft woods. The industrialists want to invest their money in the manufacture of sawn sizes, plywood, pulp, paper, particleboard, chipboard and rayon if long term supplies of raw materials are assured to them. The planning to ensure the distribution of these new industries in the correct locations with reference to the supply of raw material and the scale of production, distance from forests, rail heads and the size of prospective markets and price trends at home and abroad is the real problem in many states.

Apart from the primary function of growing wood and supplying raw materials to the various wood-based industries, forests have the vital role, especially on mountains and uplands, in relation of water supplies, erosion, floods, shelter for farm animals, recreation, scenery and wild life. Protection and productive forests should be clearly distinguished and demarcated and correct data maintained.

In India and some other countries there is the urgent need of Nature Reserves or National Parks for the benefit of the people. The people must preserve for themselves and for posterity some primeval beauty that transcends even what their eyes can see and enjoy. The Nature Reserves are to be designed for preservation without altering their wilderness character. They include a scene of unique natural interest and beauty; an area far away from the sight, sound and fumes of civilization; an exclusive spot where one can feel free from modern civilization; a place where one can experience a feeling of adventure; a condition where full enjoyment depends upon one's own perception physical skill and self reliance. The forests, the native wild life, the natural or historic objects or monuments contained therein, the plants which mantle hills and dales, the towering Teak and green grass are all protected. There is no logging or mining. Their meadows are free from cattle grazing.

One who knows the tangled skein from which all things come and observes the wind blown tiny speck of seed growing into a massive tree 350 feet tall; the regularity of distribution of leaves on the stem to catch the sunshine; the miracles that the leaf perform when it manufactures chlorophyll and prepares its own food (energy rich carbohydrate sugar and cellulose) in a process called photosynthesis in the tiny bodies chloroplasts contained in the chlorophyll by absorbing the radiant energy of sunlight from above and carbon-di-oxide from below and water from the ground via the tree and initiating a series of chemical changes; the cellular anatomy of the tree; the ascent of nutrient sap from roots which probe as much as 40 feet under the ground to a great height through the stem to the leaf and from the leaf to the root; the evaporation of water through its leaves by a complex system of transpiration which involves at least five different processes; the annual girth increment the tree puts on through the paper-thin tissue of cambium cells

which divide and the new cells on the inside from xylem or wood, while the outer ones become phloem (outer bark); stimulation and control of plant growth; plant ecology and plant interrelations ranging from symbiosis to lethal parasitism, ultimately knows life in its new dimensions and sheds off fear. Then he knows the joy of being close to the earth, of walking in its forests unafraid, and being on familiar terms with its life. The grandeur of mountains and valleys, distant peaks and meadows lush with grass, glistening lakes and streams, the sound of wind and water, the panorama of clouds and the colours of sunrise and sunset and moon rise, the twinkling stars, the pageant of fireflies and the colourful flowers, the song of birds at dawn in a forest, the wonders of mushrooms, ferns and orchids all exhibit their beauty, inspiration and spiritual value. By the way, it is good that our school children are taught "Tree planting" but it would be better still to tell them that by injuring the tree-bark they destroy wonderful "Nature's monuments".

There are over 500 different species of mammals in India and some 2,061 varied species and sub-species of birds of which over 350 are winter visitors from the North. Birds and bees pollinating flowers; Ducks, Teals and Storks flying during their migration; the Pea-fowl and jungle-fowl flapping up into the trees; the tall White Storks (*Ciconia ciconia*) soaring and circling on thermal currents high up in the air; the long-legged and long-necked and pink-billed rosy white Flamingos (*Phoenicopterus roseus*) gathered in thousands in their nesting ground in the Great Rann of Cutch; the gay black-faced Langurs (*Semnopithecus entellus*) racing about the tree tops, the reddish-gray Indian Wild Ass (*Equus hemionus khur*) wading freely from one grassy island to another in the Little Rann of Cutch; the Spotted deer (*Axis axis*) bearing three-tined graceful antlers (31"-34") sniffing the morning air in the jungle; the Brown-antlered deer or Thamin (*Cervus (Panolia) eldi*) of Manipur valley with dark brown coat and handsome, almost circular antless (35"-42") set in the head at right angles to the pedicel, moving about in small herds in a floating swamp; the Swamp deer or Barasingha (*Cervus duvaucelli*) of the Terai and the Sunderbans with splayed hoofs and larger skull and antlers (30"-41") bearing 10 to 14 points, in huge herds feeding till late in the morning and when alarmed the entire herd setting up a shrill baying cry; the Indian Sambhar (*Cervus unicolor*) with stout and rugged three-tined antlers (30" and above in the male) and yellowish-grey coat, moving amazingly silently

through dense jungles or fleeing fast; the Kashmir Stag or Hangal (*Cervus elaphus hanglu*) with light brown coat and fine spreading antlers (40" and above) with points 10 to 12 wintering at about 5,000 ft. in the densely wooded mountain slopes to the North of the valley of Kashmir, but climbing up to between 9,000 and 13,000 ft. during the summer; the Musk deer (*Moschus moschiferus*) with a dark brown coat speckled with grey and without horns and face glands but the male having an abdominal musk pod containing usually an ounce of musk, exhibiting its curiosity and love of flute music of the shepherd in the Himalayan meadows – 8000 ft. (Kashmir and Himachal Pradesh); the Nilgai or Blue Bull (*Boselaphus tragocamelus*) the largest Antelope of Asia with high withers and lower rump, dark mane and short cone-like horns (8"-11¾ ") grazing and browsing in the sparsely clad hill forests of Peninsular India and resorting to the same spot to deposit its droppings; the Indian Antelope or Black buck (*Antelope carvicapra*) the sole representative in India of the genus Antelope, with its beautiful spiraled horns (16"-20") – (female seldom horned) in herds of 20 or 30 grazing till near noon and resting during the hot hours of the day in the Indian plains except the Malabar coast; the Four-horned Antelope or Chowsingha (*Tetracerus quadricornis*) dull brown in colour moving about with his hornless doe in a herd of 10 to 20 in the sparsely wooded hill country; the Nilgiri Tahr (*Hemitragus hylocrius*) a wild goat, with stout, wrinkled curved horns (17½" in the male and 14" in the doe) and sleek yellowish brown coat, grazing in flocks of 6 or more in the grassy upland downs of the Nilgiris and the Annamalais (4,000 to 5,000 ft.); the reddish-brown coloured Himalayan Tahr (*Hemitragus jemlahicus*) a wild goat with a well built body covered with flowing hair, finely formed head with short close-set horns (12"–15") curved backwards, grazing in the open clearing on towering cliffs (10,000 to 12,000 ft.) in the Himalayas from Pir Panjal to Sikkim; the Himalayan or Asiatic Ibex (*Capra ibex sibirica*) a sturdy goat of yellowish hue with big scimitar like knobbed horns, (40"–45") the male bearded, in herds of 12 to 40, grazing in the morning on precipitous cliffs and ridges (12,000 to 15,000 ft.) of the Western Himalayas; the Markhor (*Capra falconeri*), the king of the wild goats with a reddish-brown coat, magnificent, diverged, spiraled horns (record 65" measurement) long, flowing beard, agile like Ibex, standing sentinel on the top of the mountain ranges of Nanga Parbat in Kashmir; the Bharal or Blue sheep (*Pseudois nayaur*) – bearing characteristics intermediate between the sheep and goats – with

brownish-grey coat suffused with slaty blue, round smooth horn (23"-24") curved backwards over the neck, in flocks of 10 to 40, feeding and resting at higher altitudes up to 16,000 ft. in the main Himalayan Range, numerous on the Northern slopes than on the Southern; the urial or shapu (*Ovis orientalis*) a handsome sheep of rufous grey or fawn colour, the ram with a great black or grizzled ruff on the chin and big horns (20"-30") strongly wrinkled, close-set and curved round in a circular sweep, in herds of 7 to 25, inhabiting steep grassy hill slopes above forests in Punjab, Kashmir, Gilgit, Astor, Ladak and Sind; the Nayan or great Tibetan Sheep (*Ovis ammon hodgsoni*), light brown in colour and the ram with a white ruff and massive curling horns (36"-40"), wandering on the crest of the Zasker Range in Ladak (15,000 ft.) in summer; the grey Himalayan Goral (*Naemorhedus goral goral*) a coarse-haired, stocky goat-antelope with short insignificant horns in flocks of 4 to 8 feeding on rugged grassy hill sides of Kashmir and Kumaon (5,000 to 9,000 ft.); the Himalayan Serow (*Capricornis sumatraensis*) an ungainly animal with large head and ears, short, massive horns (9"-10"), blackish grey-roan coat, short limbs with widely splayed hoofs in the Himalayas to the South of the main axis at an altitude of 6,000 to 10,000 ft. dashing away with a hissing snort; the Brown Bear (*Ursus arctos*) of the Central Himalayas (10,000ft.) which is followed by crows to settle in the spot where it has rooted, The Himalayan Black Bear (*Selenarctos thibetanus*), the most carnivorous of bears killing sheep and goats and in summer picking wild fruits and berries in Kashmir and the Himalayas (10,000 to 12,000 ft.); the Sloth Bear (*Melursus ursinus*) of the forested tracts of India with a whitish V-shaped breast patch, carrying her cubs on her back to and from her feeding grounds; a Tiger (*Panthera tigris*) loping leasurably nearby; a prowling Panther (*Panthera pardus*); a yawning Asiatic Lion (*Panthera leo persica*) displaying his big fangs, impressive mane, massive chest and muscular thighs in the midst of his reposing pride under the bushes on the river bank in Gir forest; a clouded Leopard (*Neofelis nebulosa*) with its light yellowish brown coat plentifully marked with black in leaf-like patterns in attractive fashion, after a prey; the Civet marking his territory by leaving traces of a pomade substance secreted by glands and stored in pouches beneath the base of his tail on various tree trunks and boulders; the striped Hyena (*Hyaena hyaena*) with its massive molars capable of chewing bones; the porcupine (*Hystrix leucura*), the largest rodent with its formidable rattling Guills that comes out at night in search of food; the

Malabar squirrel (*Ratufa indica*) the loveliest of the rodent family, beautifully coloured in mahogany, black and old gold, with its tail trailing behind; the wild Dog (*Cuon alpinus*) one of the most ruthless of Nature's hunters; the scaly Ant-eater or Pangolin (*Manis crassicaudata*) with a coat of overlapping scales, ripping open a nest of ants with its curved claws of its front feet; the Indian Bison (*Bos gaurus*) with massive horns (30" and above) dark brown coat and white 'Stockings' and small and close-knit hoofs, grazing or resting on long grass on a look out that commands all views; the formidable Indian slaty black Wild Buffalo (*Bubalus*) with large head, small ears and longer horns (record horn measurement $73\frac{3}{8}$ inches) and large, wide splayed hoofs, concealed in tall grass; the great Indian one-horned Rhinoceros (*Rhinoceros unicornis*) of massive build, boat shaped head with a lance like horn (15"-16") and heavy hide with deep folds on the shoulders and thighs, wallowing in water or wandering freely with its tick-picking bird on its back; a solitary Tusker (*Elephas maximus*) scaling a hill, browsing tender branches and bamboo leaves; all these wonderful wild animals and birds have their place in the forest, grass lands and mountains of India. The sight of their most amazing Pageant in their wilderness brings a realization that the earth does not belong to man alone and instils (for the moment, at least) a sense of proportion.

It is a dismal comment on our civilization that since 1900 many animal species have disappeared from the face of the earth and forests are devastated. A man moves in, the larger spectacular mammals begin to disappear. Either they 'take to the hills', go into hiding, or face extirpation in one way or another. The remaining animals are wary. The spotted deer or cheetal, which were once not nocturnal at all tend to become largely so. To find even the larger remaining animals the naturalist with the most benign intentions is compelled to act like a hunter and stalk his game with extreme precaution. Even a buck and doe stand guard while their fawn drinks daintily in a pool or stream. The wild life has obviously grown scarcer. The deer are shy and seek closer cover. The Tiger and the Rhinoceros move like a silent shadow through the hilly country bordering plains. They have come as nearer extinction as any. A few among these animals are still alive especially the Rhinoceros in the Kaziranga sanctuary. The Asiatic Lion also has just been saved. Some 285 lions have been counted recently in Gir Sanctuary (1965

cnesus). A few thousand Wild Ass or Onager are safe in the little Rann of Kutch. In the open country the Black Buck (*Antelope cervicapra*), the Chnkara or Indian Gazelle (*Gazella gazella*), the Muntjac or Barking Deer (*Muntiacus muntjak*) and among birds the great Indian Bustard (*Choruotis nigriceps*) and the Floricon (*Sypheotides indica*) are likely to be extinct at no remote date.

Animals and birds do need land and solitude just as men do, sometimes in order to reproduce themselves and perpetuate their species in peace. Man's greatest mission is to protect life, not to destroy it. Our virgin forest areas have almost gone. At least the remaining areas, and as many kinds should be preserved. As the continuity of forests is broken with the advance of industry and agriculture, Elephants, Bisons and other animals, for instance in Mysore State, are feeling difficult to pass from one pocket of jungle to another in search of food and water. They need to be rehabilitated in a permanent area of jungle sanctuary large enough with food and water and a sprinkling of salt licks to carry a reasonable number of elephant herds and other animals.

It needs foresight, courage and determination on the part of the Forest Department to tackle the problems of conserving diminishing Wild Life stocks by up-to-date methods. The problems are vast and urgent. The recalcitrance of a rising population, the increased efficiency of modern weapons, the ubiquitous jeep and the terrible encroachments of ever increasing herd of cattle and buffaloes are the menaces to the wild life.

In a new plan conservation measures should be indicated for protecting some selected forest area as 'Nature Sanctuary' and for protection of Wild Life by allotting suitable Wild Life sanctuaries in each district or State. That would be the only solution for saving the local wild life and its habitats. Rangers must be trained in principles and techniques of Wild life conservation and management.

A fairly extensive ecological unit comprising blocks of Evergreen and Semi-evergreen forests, sholas, moist and dry deciduous forests and scrub forests, hills and valleys, streams, water holes, salt-licks, etc., suiting and accommodating wild animals and birds to different habitats should be selected. The jungle sanctuaries should be permanently protected and improved and well managed because of their botanical, zoological and scenic

interest. Such sanctuaries are quite necessary to study and determine the carrying capacities and different ecological habitats, factors limiting the increase of wild life populations and how they can be overcome; territorial and breeding habits, their physical make-up and their modes of life; the significance of migrating movements; food and water preferences of different species in their natural setting; the precise niche-functions of each species in the biotic community and its inter-relationship within the whole habitat; particularly its effect on soil and water; the role of predators such as tigers, lions, leopards, wild cats and wild dogs and the effect of natural predation; the effect of fire and its use as an instrument of habitat management, etc.

The primary object of the Forest Department is to produce a crop from the soil. In doing this it is inevitably creating and then conserving a range of habitats and of scenes which with a little bit of special attention and management, can be complimentary to the Wilderness parks and the Wild Life sanctuaries set apart. In those places people can learn about the flora and fauna, soil conservation and the conservation of Wild Life and understand the order of Great Nature and the interdependence of life in its natural setting and seek the spiritual refreshment that being natural can produce. Forests, Nature Reserves and Wild Life sanctuaries are a nation's assets. They belong to all. Everyone benefits from such conservation. That is why they must be conserved and looked after as a living gift for posterity.

References

1. The Advancement of Science. Vol. 22, Nos. 91 and 100. January 1965 and October 1965— The British Association for the Advancement of Science, London.
2. Kliment Timiryazev (1958) – The Life of the Plant. Foreign Languages Publishing House, Moscow.
3. Dehra Dun Forest Research Institute (1961)- Hundred Years of Indian Forestry – 1861-1961. Vols. I & II. The Manager of Publication, Civil Lines, Delhi.
4. Country Life- London 1963.

6. G. Burrard (1923)- Big Game Hunting in the Himalayas and Tibet. Herbert Jenkins Ltd., 3, York Street, James's London S.W.I.
7. J.Z. Young (1957)- The Life of Mammals. The Clarendon Press.
8. C.H. Keeling (1962)- Meet the Mammals. George G. Harrap & Co., London.
9. Philip Street (1961)- The Vanishing Animals Faber and Faber, 24 Russel Square, London.
10. U.S. Department of Agriculture (1964)- A Manual of Conservation of Soil and Water. Oxford Book Company.
11. The Zoological Society of India (1962)- Proceedings of the First All India Congress of Zoology 1959, C/o Zoological Survey of India, 34 Chittaranjan Avenue, Calcutta-12.
12. Nelson Beecher Keys (1957)- America's National Parks. Double Day and Co., Inc. Garden City, New York.

Status of Flora in Protected Areas

The case studies of eight PAs of Madhya Pradesh (India)
(The Satpuda, Bandhavgarh, Indravati, Madhav National parks and
Nauradehi, Pachmarhi, Ratapani, Sanjay-Dubri sanctuaries)

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Key-words

Protected Areas (PAs), Shannon-Wiener biodiversity index,, Point-centered Quadrant (PCQ) method, index of evenness, proportional abundance, Red Data Book (RDB) status, species diversity, index of dominance.

Introduction

The term 'Biodiversity'- a synonym for the variety and variability of all life on this earth, represents the very foundation of human existence. By our heedless actions we are eroding this biological capital at an alarming rate. Besides the profound ethical and aesthetic implications, it is clear that the loss of biodiversity has serious economic environmental and social costs. The genes, species, ecosystems and human knowledge which are being lost represent a living library of options available for adopting to local and global change. Biodiversity is part of our daily lives and livelihoods and constitute the resources upon which families, communities, nations and future generations depend (Elizabeth Dowdeswell, UNEP, 1995). Classification is an essential process in our daily lives and a necessary tool for our survival (Heywood & Baste, 1995). For example, we need to know which plants, animals fungi are useful and which are poisonous or dangerous, Biological diversity (or in concise form 'biodiversity') means the variability among living Organism from

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all sources, including, inter alias, terrestrial marine and other aquatic ecosystems and the ecological complexes of which they are part, this includes diversity within species, between species and of ecosystems (Rio Convention, 1992). Thus biodiversity means the variability among living organisms from all sources including, inter alia, terrestrial marine and other aquatic ecosystems and the ecological complexes of which they are part, this includes diversity within species, between species and of ecosystems (Rio Convention, 1992). Thus biodiversity means the variability among living organisms from all sources and the ecological systems of which they are a part, this includes diversity within species, between species and of ecosystems (Bisby, 1995). Humans depend on biological resources for food energy, construction materials, medicine, inspiration and much else besides. Further, biological resources have the critical character of being renewable, so with proper management they can be used sustainably (Mc Neely et al, 1995), ensuring their use for our future generations. Diversity can be determined by the number of species per unit area or volume it contains, (a) that of richness or number of species, and (b) that of richness of distribution of the individuals within each species. It is hard to measure biodiversity. The Shannon Wiener biodiversity index based on the proportional abundance of the species, provide an alternative approach to the measurement of biodiversity.

The ecologists may prefer full shape of the species abundance, distribution or simple richness/dominance measures, but general consensus that enriched or polluted systems display a reduction in diversity (Schafer 1973; Rosenberg 1976; Wu 1982). May (1981) noted that stable, equilibrium communities often follow a long normal pattern of species abundance. Gray & Mirza (1979) and Upland & Gray (1982) have supported the idea that pollution-induced disturbance can be monitored by a departure from a 'log normal distribution' to one where there is increased dominance. Shannon index is widely adopted in pollution monitoring (Magurran, 1988). Poiner & Kennedy (1984) used the Shannon index to measure the impact of dredging on the marine beaches of large tropical sub-littoral sand-bank off Queensland, Australia. They recorded a significant decrease in diversity in the dredged

areas. It is worth asking whether an increase in species diversity is actually an indication of measuring environmental quality. Initially, enrichment may cause an increase in diversity (Tilaman 1982), but this can be at the cost of a shift in the composition of the community (Magurran 1988). For example, an oligo-trophic lake/nala experiencing moderate inputs of phosphates and nitrates may acquire more species, but definitely it is not a sign of the better system. The major applications of diversity measurement are in nature conservation and environmental monitoring. In both the cases diversity is held to be synonymous with ecological quality (Magurran, 1988). Diversity measures are used extensively to gauge the adverse effects of pollution and environmental disturbance. Conservationists, who rate diversity most highly amongst their criteria for site assessment, concentrate almost exclusively on measures of species richness. The conservation strategies may be improved if information on species abundance patterns is taken into account.

India is very rich in biodiversity at ecosystems and species level and ranks sixth among 12 mega-diversity in the world and holds two biodiversity hot spots. Out of 1.7 million globally described species (GBA, 1995), India possesses 49,219 species of flora (about 15% of Global known plant species) and 81,251 species of fauna (about 6.7% of the Global faunal species). So India's contribution in terms of floral and faunal species stands at about 7 percent of the Global species (Kotwal, 1997). About 4,900 species of flowering plants or 33% of recorded flora are endemic to the country which are distributed over 141 genera belonging to 47 families (MOEF, 1997) located at 26 endemic centres. Tropical leguminous tree and 43 species belonging to 26 genera have been retrieved. This approximately equals the plant diversity of all the height. India is considered to be homeland of 167 important cultivated plant species and some 320 species of their wild relatives. Among the monocotyledons out of 588 genera occurring in the country 22 are critically endemic.

The Central Indian State, Madhya Pradesh possesses about 2,400 species of plants, 50 species of mammals and 600 species of birds including several endemic and endangered species (Mishra 1995). Roy et al. (1992) described in detail 881 species, 529 genera and 128 families of flowering

plants found in the Damoh and Chatarpur districts of the State; out of these 237 species in 127 genera and 31 families belong to Dicots. The proportion of monocots to Dicots is 1:237 and total genera to species is 1:166 taking into account the entire Indian sub-continent. However, Hooker (1904) gives the proportion of Monocots to Dicots as 1:23 and genera to species 1:7. The percent distribution of the species among the main 'life-form classes' (Ellenberg & Mueller-Dombois 1974a, 1974b) found in Madhya Pradesh are 20 *Phanerophytes*, 6.7 *Nanophanerophytes*, 13 *Chamaephytes*, 4 *Hemicryptophytes*, 4 *Geophytes*, 5 *Therophytes*, 38 *Hydrophytes*, 9 *Lianas*, and 0.29 *Epiphytes* (Roy *et al* 1992). Classification of the plants into various life-forms reveals the plant-climate of an area. According to Meher-Homji (1964) the plant-climate in 'semi-arid' zone of Madhya Pradesh is thermo-phanerophytic, while Roy & Shukla (1985) reported this thermo-phanerophytic plant-climate for the entire State. The ten dominant families found in Madhya Pradesh are, in the descending order, *Poaceae*, *Leguminosae*, *Asteraceae*, *Cyperaceae*, *Euphorbiaceae*, *Acanthaceae*, *Convolvulaceae*, *Melvaceae*, *Lamiaceae*, and *Rubiaceae*.

The survival and well being of the present day human population depends on several substances obtained from plants and animals. The multi-purpose needs of mankind are also met by wild and domesticated animals and plant species. Indeed the bioversity in wild and domesticated form is the same for most of the humanity's food, clothing, housing, much of cultural diversity and most of the intellectual and spiritual inspiration. It is without doubt the very basic of human's being. The loss of biodiversity is a global crisis. There is hardly any region on the Earth that is not facing ecological catastrophe. Biological extinction has been a natural phenomenon in geological history. Due to man's intervention, the rate of species' extinction has been increased manifold from 'one species every 1000 years' – at the turn of this century to 'one species every 10 years'- two decades before. Currently it is perhaps 'one species every year'- the most critical and dangerous situation from the biodiversity point of view (GBA 1995).

Thus, the diversity of the forests of Madhya Pradesh including the PAs is adversely affected by geometric rise in population which caused the serious

depletion of natural resources which in turn affected the management of forests and PAs. So, this multi-purpose integrated project was taken up for (i) assessing the status of flora and fauna, (ii) computing the economic indicators and (iii) assessing the socio-economic status of the people of the PAs in each of the eight PAs of Madhya Pradesh (Kushwah 1996, 1998). All these studies are very important in order to suggest the prescriptions for the better management of the PAs. The integrated approach with active involvement of the local people was adopted for planning and management of the PAs. Here we shall discuss only the 'status of flora' part of the study.

Study Area

All the Protected Areas taken up for the present study are located in the state of Madhya Pradesh, India. The PAs were selected randomly representing one National Park and one sanctuary, i.e., two PA units from each biogeographic zone/province. The details of the selection procedure for the PA-units are illustrated in Box-1. The Physical and biogeographic features of the eight PA-units are discussed below.

Physical Features

The **Bandhavagarh National Park (BNP)** is located in Shahdol and Jabalpur districts, latitude 23.30° N and longitude 80.58° E, with the area of 407 km^2 . It was established on 11.05.82 as per the legal provisions of the wildlife act, 1972.

The **Indravati National Park (INP)** is located in Bastar district latitude between 18.51° to 19.51° N and longitude between 80.16° to 80.44° E, with the total area of 1258 km^2 . Both of these national parks also possess the special category of "Tiger Reserves", established by the GOI under the Project Tiger, India.

The **Madhav National Park (MNP)** located in Shivpuri district, latitude between 24.80° to 25.55° N and longitude 77.20° and 78.50° E, with the area 337 km^2 .

The **Satpura National Park (SNP)** located in Hoshangabad district, latitude between 21.19° to 22.40° N and longitude 77.57° to 78.34° E, with the area of 524 km^2 .

The **Nauradehi sanctuary (NWS)** is located in Damoh, Sagar and Narsinghpur districts, the latitude 23.35° N and longitude 79.35° E, with the area of 1035 km^2 . It was established on 01.02.84 as per the legal provisions of the wildlife act, 1972.

The **Pachmarhi sanctuary (PWS)** is located in Hoshangabad district, the latitude between 21.19° to 22.40° N and longitude 77.57° to 78.34° E, with the area of 462 km^2 . It was established on 01.06.77 as per the legal provisions of the wildlife act, 1972.

The **Ratapani sanctuary (RWS)** is located in Sehore and Raisen districts, the latitude 23.31° N and longitude 77.31° E, with the area of 689 km^2 . It was established on 02.07.78 as per the legal provisions of the wildlife act, 1972.

The **Sanjay-Dubri sanctuary (SDS)** is located in Sidhi district with the area of 365 km^2 . It was established on 30.08.75 as per the legal provisions of the wildlife act, 1972. (Gangopadhyaya, 1986; WII data base, 1995; Kushwah, 1996).

Biogeographic Features and Biodiversity Values

The BNS, SNP, PWS, RWS, SDS are situated in the 'Central highland' biogeographic zone. The BNP, RWS and SDS come under the province of Vindhya-Baghel Khand and the SNP and PWS in the Satpura-Maikhal. The INP is situated in the Eastern highland zone and the MNP in the semi arid zone. The SWS is situated in the 'semi-arid' biogeographic zone within the Malwa plateau. The major biomes are tropical dry and moist deciduous, tropical secondary scrub forests in the PAs under study. The vegetation status of INP is vulnerable and of BNP, MNP and SNP is endangered. The biodiversity values for BNP, INP, SDS and RWS are high species diversity, regional connectivity, large predator-prey system. For MNP and NWS the biodiversity value consists of moderate species diversity. For SNP and PWS

these are high species diversity and regional connectivity and large predator-prey system. Box-2 illustrates various threats to India's biodiversity which are equally true in case of Madhya Pradesh too. It is clear from the Box-2 that although the exact extent of loss of forest cover is difficult to access, the major threats faced by the forest ecosystems in India may be recognised as (MOEF, 1997):

- * Commercial clear-felling and selective clear-felling
- * Conversion for agriculture, settlements, roads, etc.
- * Inundation for development projects (like multipurpose river valley projects)
- * Shifting cultivation
- * Conversion to monoculture
- * Army operations
- * Grazing
- * Fuelwood collections
- * Mining
- * Introduction to exotics
- * Fire and
- * Pollution.

Methodology

The secondary data has been collected from the relevant records, whereas the primary data has been collected from the field works using pre-tested questionnaires/interviews/observations/mensuration. The samples were selected using PPS sampling method. The size of the sample depend on the size of the population. The size of the quadrant has been decided at field after using the concept of minimal areas of species areas curves. The modified PCQ (Point Centred Quadrant) method (Sale & Berkmuller 1986; Kushwah 1996) was used in order to assess the faunal status in addition to the traditional census methods. In this method, from the baseline perpendicular transact-line was laid out and the sample points were selected at the interval of 50 metres (practically 50 paces). From each sample point, the four quadrants were obtained by dividing the transact-line perpendicularly and the distance of the nearest tree from the center point (D) in each

quadrant was measured (in metres) along with the other phenological details of the floral species. The area of 50 m × 25 m on both sides of the transect-line in each quadrant was observed for the faunal signages (e.g., scats, dropping, digging, etc.) in addition to the actual sighting of the species. The census data from the PAs were also taken up. Non-availability of past data especially of the period when the forests were declared as PAs, has become an obstacle in calculating the initial biodiversity indices; hence a comparison could not be made with the present biodiversity indices. The present biodiversity index has been calculated with a view to assess the present status of flora in the PAs under study. For this, the Shannon-Wiener biodiversity index (H) has been calculated. The details of these biodiversity indices and the method of their computation are summarized in Box 3.

Results and Discussions

The concentration and dominance of species at different sites showed that all forest are stable in their respective ecological gamut. However, in teak, Sal as well as miscellaneous forest, dominance was observed to be shared between many species. This indicates the declining state of Sal in the forests of the PAs and stability of the plant communities in the forest as a whole. All the sites are well managed forest of the territorial forest divisions before being established as PAs under the provisions of Wildlife (Protection) Act, 1972. In spite of different intensity of management inputs and degree of biotic pressure, the forests show a good measure of diversity. In an ecosystem, it is the large number of rare species that largely determine the species diversity. In managed forest, it is obvious that the species diversity tends to be low. More to it, the increasing trend of biotic pressure also depresses it more. However, considering the whole gamut of issues of diversity in the background of forest management the high value of biodiversity indices indicate a good measure of biological control and ecological health of the forest. As reported by Knight (1975) the ideal value for species diversity for tropical forests is 5.06 to 5.4. Therefore, considered in this perspective, certain pockets of forests in every PA should be proposed in their management plans as biodiversity zones. Appropriate measures should be prescribed to decrease management and anthropogenic affects and to increase biological control.

The Case Studies

Table-1: Status of Flora in Eight Protected Areas

	Site-1			Site-2			The comparison of the biodiversities in two sites				
Name of the Pas	H'1	E1	Var H'1	H'2	E2	Var H'2	t'	df	Floral Status		more diverse (Site no.)
									H'	E	
BNP	1.796	0.539	0.0062	1.833	0.550	0.0068	0.325	762	M	M	2
INP	1.801	0.540	0.0061	1.883	0.565	0.0058	0.753	896	M	M	2
MNP	2.505	0.752	0.0071	2.511	0.754	0.0061	0.055	289	VG	VG	2
SNP	2.198	0.660	0.0048	2.254	0.676	0.0047	0.570	731	G	G	2
NWS	2.172	0.636	0.0078	2.261	0.676	0.0068	0.74	419	G	G	2
PWS	1.727	0.518	0.0073	1.763	0.537	0.0068	0.30	656	L	M	2
RWS	1.831	0.549	0.0086	1.788	0.537	0.0087	0.33	583	M	M	1
SDS	1.962	0.589	0.0069	1.741	0.522	0.0082	1.80	681	M	M	1

Diversity (H')

Low (L) = $H' < 1.75$, Moderate (M) = $1.75 > H' > 2.00$, Good (G) = $2.00 > H' > 2.50$,

Very Good (VG) = $H' > 2.5$

Evenness (E)

Low (L) = $H' < 0.5$, Moderate (M) = $0.5 < H' < 0.6$, Good (G) = $0.6 < H' < 0.75$,

Very Good (VG) = $H' > 0.75$

(Source : Kushwah, 1996)

1. Case of Bandhavgarh NP

In the sample plot number 1 and 2 (at Sites 1 & 2) of BNP, the floral index is 1.796 and 1.833 respectively; it means that in the forest area of Site-2 there

is higher proportion of dominant species (sal- *Shorea robusta*) in comparison to the Site-1, and also Site-2 have more richness or number of species than Site-1. The diversity of sample plot number 1 area (Site-1), $H'1 = 1.796$ while the diversity of sample plot number 2 area (Site-2), $H'2 = 1.833$. These values represent the sum of the 'pi ln pi'. The formula for the Shannon-Wiener index commences with a minus sign to cancel out the negative created by taking the logs of proportions. The evenness of distribution of the individuals within each species may be computed for these two forest sites, using the formula $E = H'/\ln S$: $E1 = 0.539$; $E2 = 0.550$. It means that the evenness in the distribution of the individuals within each species is more in case of site 1 than in case of site-2 forest area.

The variance in diversity of the two forest areas has been estimated using formula given in Box-4. The values obtained are: $\text{Var } H'1 = 0.00624$ and $\text{Var } H'2 = 0.00680$. The calculation of 't' to test for significant differences between samples in order to compare the diversities of the two forest lands. Here the value obtained $t = 0.325$. The required degree of freedom (df) has also been computed, $df = 762$. The t-test reveals that the two type of forest sites (areas) are not very significantly different in terms of the diversity of dominant species (*Shorea robusta*) but the forest of Site-2 is more diverse than the Site-1 area in BNP (Please refer Table 1).

2. Case of Indravati NP

In the sample plot number 1 and 2 (at Sites 1 & 2) of INP, the floral index is 1.801 and 1.883 respectively. It means that in the forest area of Site-2 there is higher proportion of dominant species and the richness of species is also more in Site-2 in comparison to Site-1. The diversity of sample plot number 1 area (Site-1), $H'1 = 1.801$ while the diversity of sample plot number 2 area (Site-2), $H'2 = 1.883$. The evenness of distribution of the individuals within each species may be computed for these two forest sites, using the formula $E = H'/\ln S$: $E1 = 0.540$; $E2 = 0.565$. This shows that evenness of distribution of individuals within each floral species is better in Site-2 than Site-1.

The values of the variance in diversity of the two forest areas has been estimated as : $\text{Var } H'1 = 0.0061$ and $\text{Var } H'2 = 0.0058$. The calculation of 't' to test for significant differences between samples in order to compare the

diversities of the two forest lands. Here the value obtained, $t=0.753$. The required degree of freedom (df) has also been computed, $df= 896$. The t-test reveals that the two type of forest sites (areas) are significantly different up to certain extent in terms of the diversity of dominant species, but the forests of Site-2 are more diverse than the Site-1 area in INP (Please refer Table-1).

3. Case of Madhav NP

In the sample plot number 1 and 2 (at Sites 1 & 2) of MNP, the floral index is 2.505 and 2.511 respectively. It means that the forest areas are not much different, in terms of the proportion of dominant species and species' richness. The diversity of sample plot number 1 area (Site-1), $H'_1 = 2.505$ while the diversity of sample plot number 2 area (Site-2), $H'_2 = 2.511$. The evenness of distribution of the individuals within each species may be computed for these two forest sites, using the formula $E = H'/\ln S$: $E_1 = 0.751$; $E_2 = 0.754$. This shows that evenness of distribution of individuals within each floral species is more or less same.

The values of the variance in diversity of the two forest areas has been estimated as : $\text{Var } H'_1 = 0.0071$ and $\text{Var } H'_2 = 0.0061$. The calculation of 't' to test for significant differences between samples in order to compare the diversities of the two forest lands. Here the value obtained, $t = 0.055$. The required degree of freedom (df) has also been computed, $df = 285$. The t-test reveals that the two type of forest sites (areas) are not significantly different in terms of the diversity of dominant species, and the forest area of Site-1 and Site-2 are more or less similar in diversities of flora in MNP (Please refer Table-1).

4. Case of Satpuda NP

In the sample plot number 1 and 2 (at Sites 1 & 2) of SNP, the floral index is 2.198 and 2.254 respectively. It means that the forest areas of Site - 2 is more diverse in terms of the proportion of dominant species and species' richness, than the forest area of Site-1. The diversity of sample plot number 1 area (Site-1), $H'_1 = 2.198$ while the diversity of sample plot number 2 area (Site-2), $H'_2 = 2.254$. The evenness of distribution of the individuals within each species, may be computed for these two forest sites, using the formula, $E = H'/\ln S$: $E_1 = 0.660$; $E_2 = 0.676$. This shows that evenness of distribution of individuals within each floral species is little better in Site-2 than Site-1.

The values of the variance in diversity of the two forest areas has been estimated as : $\text{Var } H'1 = 0.0048$ and $\text{Var } H'2 = 0.0047$. The calculation of 't' to test for significant differences between sample in order to compare the diversities of the two forest lands. Here the value obtained, $t=0.570$. The required degree of freedom (df) has also been computed, $df= 731$. The t-test reveals that the two type of forest sites (areas) are not very much significantly different up to certain extent in terms of the diversity of dominant species , but the forest area of Site-2 is little more diverse than the Site-1 area in SNP (Please refer Table-1).

5. Case of Nauradehi Sanctuary

In the sample plot number 1 and 2 (at Site- 1 & Site- 2) of NWS, the floral index is 2.172 and 2.261 respectively. It means that the forest area of Site - 2 is little more diverse, in terms of the proportion of dominant species and species' richness, than the forest area of Site-1. The diversity of sample plot number 1 area (Site-1) is $H'1 = 2.172$ while the diversity of sample plot number 2 area (Site-2), is $H'2= 2.261$. The evenness of distribution of the individuals within each species, may be computed for these two forest sites, using the formula, $E= H'/\ln S$: $E1= 0.636$; $E2= 0.678$. This shows that evenness of distribution of individuals within each floral species is little better in Site-2 than Site-1.

The values of the variance in diversity of the two forest areas has been estimated as : $\text{Var } H'1= 0.0078$ and $\text{Var } H'2 = 0.0068$. The calculation of 't' test for significant differences between samples in order to compare the diversities of the two forest lands. Here the value obtained, $t=0.74$. The required degree of freedom (df) has also been computed, $df= 419$. The t-test reveals that the two type of forest sites (areas) are not significantly different up to certain extent in terms of the diversity of dominant species but the forest area of Site-2 is little more diverse than the Site-1 area in NWS (Please refer Table-1).

6. Case of Pachmarhi Sanctuary

In the sample plot number 1 and 2 (at Sites - 1 & Site - 2) of PWS, the floral index is 1.727 and 1.763 respectively. It means that the forest area of

Site-2 (the teak forest) is more diverse, in terms of the proportion of dominant species and species' richness, than the area of Site-1 (the sal forest). The diversity of sample plot number 1 area (Site-1) is $H'1 = 1.727$ while the diversity of sample plot number 2 area (Site-2), $H'2 = 1.763$. The evenness of distribution of the individuals within each species, may be computed for these two forest sites, using the formula, $E = H'/\ln S$: $E1 = 0.518$; $E2 = 0.537$. This shows that evenness of distribution of individuals within each floral species is little better in Site-2 than Site-1.

The values of the variance in diversity of the two forest areas has been estimated as : $\text{Var } H'1 = 0.0073$ and $\text{Var } H'2 = 0.0068$. The calculation of 't' test is for showing significant differences between samples in order to compare the diversities of the two forest lands. Here the value obtained, $t = 0.30$. The required degree of freedom (df) has also been computed, $df = 656$. The t-test reveals that the two type of forest sites (areas) are not significantly different up to certain extent in terms of the diversity of dominant species but the forest area of Site-2 is more diverse than the Site-1 area in PWS (Please refer Table-1).

7. Case of Ratapani Sanctuary

In the sample plot number 1 and 2 (at Sites- 1 & Site- 2) of RWS, the floral index is 1.831 and 1.7881 respectively. It means that the forest area of Site-1 is more diverse, in terms of the proportion of dominant species (teak – *Tectona grandis*) and species' richness, than the area of Site-2. The diversity of sample plot number 1 area (Site-1) is $H'1 = 1.831$ while the diversity of sample plot number 2 area (Site-2), $H'2 = 1.788$. The evenness of distribution of the individuals within each species, may be computed for these two forest sites, using the formula, $E = H'/\ln S$: $E1 = 0.549$; $E2 = 0.537$. This shows that evenness of distribution of individuals within each floral species is little better in Site-1 than Site-2.

The values of the variance in diversity of the two forest areas has been estimated as : $\text{Var } H'1 = 0.0086$ and $\text{Var } H'2 = 0.0087$. The calculation of 't' test for significant differences between samples in order to compare the diversities of the two forest lands. Here the value obtained, $t = 0.33$. The required degree of freedom (df) has also been computed, $df = 583$. The t-test

reveals that the two type of forest sites (areas) are not significantly different up to certain extent in terms of the diversity of dominant species (teak), but the forest area of Site-1 is little more diverse than the Site-2 area in RWS (Please refer Table-1).

8. Case of Sanjay-Dubri Sanctuary

In the sample plot number 1 and 2 (at Sites- 1 & Site- 2) of Sanjay-Dubri Sanctuary, the floral index is 1.962 and 1.741 respectively. It means that in the forest area of Site-1 floral diversity is more, in terms of the proportion of dominant species (Sal) and species' richness, than the area of Site-2. The diversity of sample plot number 1 area (Site-1) is $H'1 = 1.962$ while the diversity of sample plot number 2 area (Site-2), $H'2 = 1.741$. The evenness of distribution of the individuals within each species, may be computed for these two forest sites, using the formula, $E = H'/\ln S$: $E1 = 0.589$; $E2 = 0.522$. This shows that evenness of distribution of individuals within each floral species is better at Site-1 than Site-2.

The values of the variance in diversity of the two forest areas has been estimated as : $\text{Var } H'1 = 0.0069$ and $\text{Var } H'2 = 0.0082$. The calculation of 't' is test for significant differences between samples in order to compare the diversities of the two forest lands. Here the value obtained, $t = 1.80$. The required degree of freedom (df) has also been computed, $df = 681$. The t-test reveals that the two type of forest sites (areas) are not significantly different in terms of the diversity of dominant species (Sal) and the species' richness. The forest area of Site-1 is little more diverse than the Site-2 area in Sanjay-Dubri sanctuary (Please refer Table-1).

Comparing the results for Eight PAs

The Table-1 shows the comparative picture of the computed values of Shannon Wiener biodiversity index (H'), index of evenness of the abundance of the species (E') variance in diversity, 't' value and the required degree of freedom for each of the eight PAs. The data reveal that the two types of forest sites (areas) are significantly different in terms of the diversity of dominant species in INP and SNP among National Parks, and in NWS and SDS among wildlife sanctuaries. Among all the eight PAs, the value 't' is maximum (1.80)

for SDS indicating that the forest in the two sample plot sites are highly significant in terms of the diversity of flora. The status of the flora of MNP among the national parks (BNP, INP, MNP, SNP), and of SDS among the sanctuaries (Nauradehi, Pachmarhi, Ratapani and Sanjay-Dubri) is more diverse in terms of the evenness of distribution of the individuals within each species and also in terms of the dominant species. The data of table-1 reveal that among the national parks, the floral species-diversity and species-richness as well as evenness of the distribution of species is moderate in four out of eight PAs, viz. BNP, INP, RWS and SDS.

Conclusions

The term 'biological diversity' or the short term 'biodiversity' is a synonym for the variety and variability of all life on this earth. It includes diversity within species, between species and of ecosystems. Classification is an essential process in our daily life and a necessary tool for our survival. It is hard to define biodiversity in mathematical terms. So 'biodiversity indices' are used for this purpose. The Shannon Wiener biodiversity index, based on the proportional abundance of the species, provide an alternative approach to the measurement of biodiversity. Attempt has been made for the first time in eight PAs, i.e., the Bandhavgarh (BNP), Indravati (INP), Madhav (MNP), Satpuda (SNP) national parks: Nauradehi (NWS), Pachmarhi (PWS), Ratapani (RWS), Sanjay-Dubri (SDS) sanctuaries of Madhya Pradesh following standard sampling techniques and formulae. The values of Shannon-Wiener biodiversity indices were computed and found to be (a) For Site-1; 1.796, 1.801, 2.505, 2.190, 2.172, 1.727, 1.831 and 1.962 (b) For Site-2; 1.883, 2.511, 2.254, 2.261, 1.763, 1.788 and 1.741 respectively for SNP, INP, MNP, BNP, NWS, PWS, RWS and SDS. The values of the index of evenness have also been computed and found to be (a) For Site-1; 0.539, 0.540, 0.752, 0.660, 0.636, 0.518, 0.540 and 0.589 (b) For Site-2; 0.550, 0.565, 0.754, 0.676, 0.678, 0.527, 0.537 and 0.522 respectively for SNP, INP, MNP, BNP, NWS, PWS, RWS and SDS. Among all the PAs under study the values of Shannon-Wiener biodiversity indices and the index of evenness as computed are found to be highest in MNP followed by SNP and NWS. The index of evenness is found to be highest for MNP, followed SNP and NWS while lowest for PWS. This comprehensive study suggests that for sustainable

development of the PAs, the following measures should be taken during the execution of management plans prepared for each PAs of Madhya Pradesh:

- * Bio-diversity zone should be demarcated and conserved for future in all PAs.
- * Necessary amendment in the management practices of the PAs be made to encourage the rare and endangered species to seeding and further colonization so as to ensure their regeneration.
- * The areas of five PAs (BNP, INP, RWS, SDS and PWS) with lower and moderate diversity indices are needed to be given more attention for protection and conservation of biodiversity. In fact, these areas being peripheral to territorial divisions are more affected by the biotic pressures from the adjoining villages which need to be minimized.
- * The Eco-development Planning adopting the integrated approach should be done for these PAs. In this planning process, local communities should be involved actively.
- * The highest pressure from tourists in SNP, BNP, PWS, RWS and SDS has to be regulated in order to improve the condition. For this 'Eco-tourism plans' should be prepared for each of the PAs.

Thus, the study is not only of academic interest but relevant for the PAs managers deciding the policy issue.

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Box-1 : How the Eight PAs were selected for this study ?

All the Protected Areas taken up for the present study are located in the state of Madhya Pradesh, India. Madhya Pradesh is also known as the 'tiger-land' of India due to maximum number of tiger population inhabiting the country. Five out of twenty-five 'tiger reserves' are located in this State only with the tiger population of 210 out of total 1385 tigers in the tiger reserves of India. Out of these, two tiger reserves were taken up for the study. The PAs were selected randomly representing one National Park and one sanctuary, i.e., two PA units from each biogeographic zone/province. The PPS sampling technique has been used of randomly [simple] without replacement [with a care to give true representation centrally located at significant distances from each other]. Twenty-five percent of the population with a minimum of one unit representing one biogeographical zone/province has been selected randomly. Thus by using this sampling technique, eight PAs were selected for this study, viz., BNP, INP, MNP, SNP National Parks and NWS, PWS, RWS, SDS Wildlife Sanctuaries. Therefore, using the above method, from the semi arid biogeographic zone [4B] (which covers 98,700 sq. km. i.e. 22.3% of the total geographical area of the State) two PAs, viz., MNP, NWS, from Deccan biogeographic zone [6] (which covers 3,43,300 sq. km. i.e. 77.7 % of the total geographical area of the State) the rest of the PAs have been selected. The last one [Deccan zone] has been sub-divided into sub-zones, viz. Eastern high lands [6C] (covers 83,000 sq. km i.e. 18.7% of the total geographical area of the State), Chhota Nagpur [6D] (which covers 34,000 sq. km. ie., 7.7% of the total geographical area of the State) and Central highlands [6E] (covers 2,27,000 sq. km-51.3% of the total geographical area of the State) (Rodgers & Panwar, 1988). The PAs, viz., INP, from Eastern highlands [6C], SDS from Chhota Nagpur [6D], SNP, PWS from Central highlands-Satpuda Maikhal [6E1], and Bandhavgarh NP, Ratapani WLS from the Central highlands-Vindhya Baghelkhand [6E2] have been selected. In this way, four NPs and four WLS have been taken up for this study. Thus, more than 50 percent of the total eight PAs i.e., five PAs, viz., SNP, BNP, NWS, PWS and RWS have been considered for this present study, from the Central Madhya Pradesh [which covers a little more than 50% of the total geographical area of the State] and the remaining PAs from rest of the State. (Source: Rodgers & Panwar, 1988; Kushwah, 1996; Kushwah & Kumar, 1998a; Kushwah & Kumar, 1998 b)

Box-2 : Threats to India's Biodiversity

India, the most populous country— second only to China, with many of the debatable development measures have had a catastrophic impact on our biodiversity. Vast areas were cleared for agriculture, human settlement, industries and water reservoirs, grazing by largest cattle population (about 500 million) in the world. The extent of dense forest has decreased by nearly 18% in the last two decades, fuel wood collection and timber extractions have left most of the remaining forests degraded hills. The extent of open degraded forest has been more than doubled ! A forty-fold increase in the use of the pesticides (from 2,000 metric tonnes in 1960 to 80,000 metric tonnes in 1990s) and similar increase in the use of chemical fertilizers have poisoned India's countryside (Anonymous, 1995). The studies of Kothari *et al.* (1989) reveals that nearly 40% of the PAs (for which data was available) have more than 500 people per sq. km inside, and more than 50% have more than 100 people per sq. km. around them. More than 20% of the PAs have more than 300 people per sq. km around them, much more than the national average of 267 people per sq. km. On the whole, about 80% of the PAs have cattle grazing, about 25% of them have more than 50 heads of cattle per sq. km (much more than the national average of 0.75 cattle per sq. km). The major impact of human activities are habitat loss (which brought about proportional reduction in population of almost all species), habitat fragmentation (which also fragmenting small population within them— a most serious threat in the long-term for the conservation of biodiversity), habitat degradation (resulting in the reduction in carrying capacity in long run), selective loss (of some taxa), pollution, and introduction of exotics (e.g., Eucalyptus, which often have no biodiversity values nor they meet local resources).

The biodiversity in India's forests, grasslands, wetlands and mountains, deserts and marine ecosystems takes many pressures. One of the major causes for the loss of biodiversity in India has been the depletion of vegetative cover in order to expand agriculture. Since most of the biodiversity rich forests also contain the maximum mineral wealth, and are also the best sites for water-impoundment, mining and development projects in such areas have often led to destruction of habitats, poaching and illegal trade of wildlife products too have adversely affected biodiversity.

Threats to ecosystems' diversity

- * Mountain ecosystems take the major negative impact of unplanned development, opening of roads, degradation of catchment areas and resultant landslides and erosion. Mountain ecosystems in Himalayas, Western Ghats and Eastern Ghats have been considered as fragile and have attracted special attention. Out of the 633,397 million hectares of forests existing in 1997 (19.27% of India's geographical area), only a little more than half had dense forest cover with crown density of over 40%.
- * Grasslands are one of the most threatened ecosystems in India. Apart from commercial pressures, they come under pressure from grazing, fire, pollution, development projects, conversion for agriculture, tree plantations and introduction and spread of exotics.
- * Wetlands: The lakes, marshes, river systems and other wetlands in the country are threatened mainly by domestic pollution from untreated sewage, industrial pollutants and toxic effluents, agricultural run-offs containing residues of pesticides and chemical fertilizers, and excessive siltation from degraded catchments. Excessive withdrawal of water from the water-bodies for industry, irrigation or domestic use, dredging and reclamation of water-bodies, excessive fishing, building of dams, jetties and canals are other factors adversely affecting the Indian wetlands. A number of wetlands are reported to be seriously threatened. These include: Wular, Dal, Harike, Chilka, Loktak and Kolleru lakes, Gulf of Khambat, estuaries of Karnataka coast, back waters of Cochin and wetlands in Andaman & Nicobar Islands.
- * Mangroves of the country are subjected to serious threats due to their reclamation for urban development (e.g., near Mumbai, Cochin and Port Blair) waste disposals, oil spillage, etc.
- * Coral reef ecosystems are threatened because of mining, blasting, dredging, collection of reef biota, coastal clearance for development,

sewage disposal, discharge of effluents from industries and thermal power plants, chemical pollution and oil spillage.

- * Deserts in India have not been subjected to serious pressures, but localised threats could result in serious damage. The sand desert of Western India, being one of the most densely populated of the world's deserts with a high livestock population faces heavy biotic pressure. The salt desert of Gujarat is not thickly populated because it is inhospitable. However, the expanding salt extraction has resulted in widespread disturbance. In the Indian cold desert, a major destructive factor is road construction which in turn leads to landslides and soil erosion. Other threats are over-grazing and excessive collection of fuelwood.

Threats to species and genetic biodiversity losses

The major factors threatening the species and genetic diversity found in India are similar to those elsewhere in the world. Threats to species and genetic diversity are directly linked to threats to the ecosystem. In addition, habitat destruction, over-exploitation, poisoning by pollutants, introduction of exotics, imbalances in community structure, epidemics, floods, droughts and cyclones affect species and genetic diversity. The diversity of indigenous varieties of livestock, crops and other cultivated plants face many threats from introduction of exotic and high yielding hybrid varieties. In this country itself, the Indian cheetah, Lesser Indian rhino, the Pink-headed duck, the Forest owlet and the Himalayan mountain quail are reported to have become extinct. Thirty-nine species of mammals, 72 species of birds, 17 species of reptiles, 3 species of amphibians, 2 species of fishes and large number of butterflies, moths and beetles, besides 1,336 plant species are considered vulnerable and endangered. About 20 species of higher plants are categorized as "possibly extinct", as these species have not been sighted during last 6-10 decades.

(Source: Kothari et al. 1989; Kushwah 1996, MOEF 1997; Kushwah & Kumar 1998 a; Kothari et al. 1998)

Box-3 : The details of Shannon-Wiener Biodiversity Index

The Shannon Wiener biodiversity index, based on the proportional abundance of the species, provide an alternative approach to the measurement of biodiversity. It is one of the information theory index, based on the rationale that the diversity or information, in a natural system can be measured in a similar way to the information contained in code or message. This index assumes that individuals are randomly sampled from an indefinitely large (that is an effectively infinite) population (Pielou, 1971). The index also assumes that all species are represented in the sample. It is computed from the equation:

$$H' = -\sum_i p_i \ln_e p_i$$

(where p_i = the proportional of individuals found in the 'ith' species)

The formula for the Shannon index commences with minus sign to cancel out the negative created by taking logs of proportions. In a sample the true value of p_i is unknown, but estimated as n_i/N (the maximum likelihood estimator) (Pielou, 1969). Use of n_i/N as an estimate of p_i produces a biased result and strictly speaking the index should be obtained from series (Hutcheson, 1970, Browman *et al.*, 1971.):

$$H' = -\sum_i p_i \ln_e p_i - (S - 1)/N + (1 - 1/N) / 12N^2 + [12N^2 (1 - 1/N)^2 / 12N^2]$$

In practice, however, this error is rarely significant (Peet, 1974) and all terms in the series after the second are very small indeed. A more substantial source of error comes from a failure to include all species from the community in the sample which increases as the proportion of species represented in the sample declines. The value of Shannon-Wiener diversity index usually varies between 1.5 to 3.5 and only rarely surpasses 4.5 (Margalef, 1972). About one lakh species will be needed to produce a value of $H' > 5.0$. The index measures concentration of dominance of species in the study area.

The variance in diversity of two samples may be estimated using the formula:

$$\text{Var } H' = [\sum_i p_1 (\ln_e p_1)^2 - \sum_i (p_1 \ln_e p_1)^2] / N - (S-1)2N^2$$

A t-test allows the diversities of two samples to be compared. The appropriate formula is :

$$t = (H_1 - H_2) / (\text{Var } H_1 - \text{Var } H_2)^{1/2}$$

The required degree of freedom must also be calculated, using the formula:

$$df = (\text{Var } H_1 - \text{Var } H_2)^2 / [(\text{Var } H_1)^2 / N_1 + (\text{Var } H_2)^2 / N_2]$$

Although as a heterogeneity measure takes Shannon's index into account the evenness of the abundance of species (Peet, 1974), it is possible to calculate a separate additional measure of evenness. The maximum diversity (H'_{max}) which could possibly occur would be found in a situation where all species were equally abundant. In other words, if $H' = H'_{\text{max}} = H' / \ln_e S$. The ratio of observed diversity can, therefore, be taken as a measure of evenness (earth's vitality and diversity) (Pielou, 1974). $E = H' / H'_{\text{max}} = H' / \ln_e S$

The maximum value of E is 1.0 which represents the "ideal" case in which all species are equally abundant.

(Source : Magurran, 1988)

Summary

The term biodiversity means the variety and variability among living organisms from all sources and ecosystems on this earth. It includes diversity within species, between species and of ecosystems. Classification is an essential process in our daily lives and a necessary tool for our survival. For example, we need to know which plant, animal fungi are useful and which are poisonous or dangerous.

It is hard to define biodiversity in mathematical term. Hence, the 'biodiversity indices' are used for the purpose. The Shannon-Wiener biodiversity index, based on the proportionate abundance of the species, provide an alternate approach to the assessment of biodiversity. Attempt has been made for the first time in the eight PAs of Madhya Pradesh, following standard sampling techniques and formulae, to compute biodiversity indices in order to find the present status of flora. The value of Shannon-Wiener biodiversity indices and index of evenness have been computed. The maximum value (2.505, 2.511) was found for MNP followed the SNP. The minimum value (1.717, 1.763) found for PWS.

The main recommendations of the study are :-

- ☞ Demarcation of the 'biodiversity zone' in each PAs and its conservation;
- ☞ The areas with lower biodiversity indices are needed to be given more attention for protection and conservation;
- ☞ The 'Eco-development planning with the active involvement of local people for each PAs along with the village micro-planning; and
- ☞ The high tourists' pressure in PWS, SNP, BNP, RWS is needs to be regulated by 'Eco-tourism planning' in these PAs.

References

1. **Anonymous. 1995.** *India's Biodiversity Project*. draft Working Paper, February 1995; WII Dehra Dun.
2. **Bisby, FA. 1995.** *Characterization of biodiversity*. In: Global Biodiversity Assessement, UNEP, CUP, UK.
3. **Dowdeswell, Elizabeth. 1995.** In : Global Biodiversity Assessement, UNEP, CUP, UK.
4. **Ellenberg, H. & Mueller-Dombois. 1974a.** *A Key to Raunkiaer's Plant Life-forms with Revised Sub-division*. In : 'Aims and methods of Vegetation Ecology', New Work.
5. **Gangopadhyay, P.B. 1986.** *Working Plans for Bori & Pachmarhi Sanctuarie — for the period 1985-86 to 1994-95*, Hoshangabad Division, GOMP.
6. **GBA. 1995.** *Global Biodiversity Assessment*. UNEP, CUP, UK.

7. Gray, J.S. & Mirza, F.B. 1979. A possible method for detecting pollution-induced disturbance on marine benthic communities. *Mar. Pollution Bulletin*, Vol. 10, p: 142-146.
8. Heywood, V.H. & Baste, I. 1995, *Introduction in Global Biodiversity Assessment*, UNEP, CUP, UK.
9. Hooker, JD. (1964). *TA sketch of the Flora of British India*. 7 Volumes, London.
10. Kothari, A. and others, 1989. *Management of National Parks and sanctuaries in India*. IIPA, New Delhi; pp:112.
11. Kothari, A. et al. 1998. *Communities and Conservation*. Sage Publishers, New Delhi; pp : 509.
12. Kotwal, P.C. 1997. *Biodiversity conservation and constraints in India*. IIRM, Bhopal, Madhya Pradesh (India).
13. Kushwah, R.B.S. 1996. *Integrated Forest Planning and Management in the Protected Areas of Madhya Pradesh (with special reference to Central Madhya Pradesh*. Ph. D. Thesis. Department of RPEG, Berkullah University, Bhopal, Madhya Pradesh (India).
14. Kushwah, R.B.S. & Kumar, V. 1998. *Benefit-cost analysis of PAs– a case study of Satpuda National Park, Madhya Pradesh (India)*. *Jouranl of Tropical Forestry*, Vol. 14 (II); p: 72-81.
15. Kushwah R.B.S. & Kumar, V. 1998a. *Status of Fauna in Protected Areas– the case studies of Eight PAs of Madhya Pradesh*; pp:1-13 IIFM, Bhopal.
16. Kushwah, R.B.S. & Kumar, V. 1998b. *Economics of Protected Areas– the case studies of Eight PAs of Madhya Pradesh (India)*; pp:1-19, Sanjay National Park, Sidhi.
17. Kushwah, R.B.S. & Kumar, V. 1999. *Status of PAs– the case studies of four PAs of Madhy Praesh (India)*; pp: 1-11, Chital 38 (I), Wildlife Preservation Society of India, Dehra Dun.
18. Magurran, A.E. 1988, *Ecological diversity and its measurement*. Croom Helm, London.
19. May, R.M. 1981. *Pattern in multi-species communities*. In 'Theoretical Ecology-principles and applications'. Blackwell, Owxford; pp:197-227.
20. McNeely, J.A. et al. 1995. *Conserving the world's biological diversity*. In: *Global Biodiversity Assessment*, UNEP, CUP, UK.
21. Meher-Homji, V.M. 1964. *Life-forms and Biological Spectra as Ephramonic criteria of Aridity and Humidity in Tropics*. *Journal of Indian Botanical Society*. Vol. 43; p: 424-430.

22. **Miller, K. et al. 1995.** *Measures for conservation of biodiversity and sustainable use of its compoments* in GBA, UNEP, CUP, UK.
 23. **Mishra P.K. 1995** *Biodiversity Conservation in Madhya Pradesh*. The paper presented in the National seminar on 'Biodiversity Conservation in mangaed forests and PAs', Nov., 25 1995, IIFM, Bhopal, Madhya Pradesh (India).
 24. **MOEF, 1997.** *National Action Plan on Biodiversity*, Ministry of Environment & Forests, GOI, New Delhi; pp: 81.
 25. **Poiner I.R. & Kennedy, R. 1984.** *Complex patterns of change in the macro-benthos of a large sandbank following dredging*. Mar. Biology (48); - 335-352.
 26. **Rio Convention. 1992.** Convention on Biological Diversity.
 27. **Rodgers, W.A. & Panwar, H.S., 1988.** *Planning a wildlife PAs network in India*. WII, Dehradun.
 28. **Rosenberg, R. 1976.** *Benthic faunal dynamics during succession follwoing pollution abatement in a Swedish estuary*. Oikos, (27), p:414-427.
 29. **Roy, G.P. & Shukla, B.K. 1985.** *A contribution to the grass flora of Madhya Pradesh*. Journal of Economic Taxanomy of Botany, Vol. 4; p: 567-573.
 30. **Roy, G.P. and others (1992).** *Flora of Madhya Pradesh*. Ashish Publishing House, New Delhi; pp: 639.
 31. **Sale, J.B. & Berkmuller, K. 1986.** *Manual of wildlife techniques for India*. Field Document No. 11, FAO, WII, Dehradun.
 32. **Schafer, C.T. 1973.** *Distribution of forminifera near pollution sources in Chaluer Bay*. Water, Air Soil Pollution, (2); p:219-233.
 33. **Tilaman, D. 1982.** *Resource competition and community structure*. Princeton University Press, Princeton.
 34. **Ugland K.I. & Gray, J.S. 1982.** *Log- normal distribution and the concept of community equilibrium*. Oikos (39); p:171-178.
 35. **WII data base. 1995.** *The Data Base*. Wildlife Institute of India, Dehradun, India.
 36. **Wu, R.S.S. 1982.** *Periodic deformation and recovery in a sub-tropical epibenth community in relatin to organic pollution*. Jr. Exp. Mar. Biology (64), project 253-264.
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Scent Marking Behaviour of Indian Gazelle (*Gazella bennetti* Sykes, 1831) in Thar Desert of Rajasthan (India)

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Key-words : Scent mark, *Gazella bennetti*, Thar Desert, Faecal pellet heaps, Bush hitting, Eye rubbing, Bed site-Path fixation.

Abstract

Scent marking patterns followed by different herds of Indian Gazelle (*Gazella bennetti*) in semi arid region of Rajasthan were investigated for one year. Generally Indian Gazelle deployed some special scent mark methods to define its territory or effective range. Among individuals of a herd the dominant male exhibited the maximum frequency of scent marking. To observe this peculiar behaviour the study was conducted at 4 different sites on total 13 various herds. In scent marking behaviour faecal pellet heaps, bush hitting by horns, eye rubbing, bed site-path fixation methods exhibited important signs.

Introduction

The Indian Gazelle (*Gazella bennetti* Sykes, 1831) is found in greater abundance in the desert of Rajasthan, Gujarat (India) and Sindh (Pakistan) (Soni, 1983). In the western part of Rajasthan, the Indian gazelle is locally known as "Chinkara" or "Chikliya". This name probably has originated from the characteristic vocal pitch (Cheenk-cheenk-cheenk) made by it when alarmed. This medium sized animal adopts many methods for marking his territory. There are diverse body zones of behavioural relevance and by specific behavioural responses termed as scent marking, the olfactory cues are released to environmental objects. The specific liberation and deposition of odourous substances on selected sites are active markings. These communication signals especially urine, faeces, saliva and secretion of some specialized skin glands play a salient role in sociobiology of some mammals (Pillai and Alexander, 1985).

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Material and Method

The present study includes four important sites of Thar Desert, viz.; Guda Bisnoian of Jodhpur district and Alai, Gogelao Enclosure and Satheran of Nagaur district. The study was conducted on 13 different herds (total 117 Indian Gazelle) in natural conditions (Wild gazelle) in above places in Thar Desert (Rajasthan, India) during all the three seasons (winter, summer and monsoon) for one year from Aug. 99 to July 2000 (Table 1). The scent pattern was studied in different habitats and localities. The behavioural activities were observed with the help of binocular (8 × 50 mm) and also through direct observation, mostly 50 metre distance from gazelle.

Territory demarcation is mainly made by made of mixed herds (territorial male) (Schaller, 1976). But in some cases male from all male herds also shows territorial display. This type of abnormal behaviour is generally found in the field only when a oestrus female came near the periphery of all male herd. During present study 4 types of marking strategies were noted: -

- A. Faecal pellet heaps.
- B. Bush hitting by horns.
- C. Eye rubbing on twigs.
- D. Bed site-path fixation.

A. Faecal Pellet Heaps:

This is well known territory demarcation method in all Bovidae and Cervidae. Male of mixed herd (territorial male) defecates near periphery of the area for demarcation of territory. Territorial male investigates all faecal pellet heaps from time to time (Schaller, 1976).

Two types of faecal heaps were observed in the present study areas. One type was found on the boundary of territory or their area limit and another type near the resting sites. Total 111 occasions were noticed out of which 56 were near the periphery and 55 were near the resting sites. It was observed that territorial male before defecation, adopted following pattern : (i) Sniffing the ground; (ii) Scrubbing the ground with the help of fore leg; (iii) Urination; (iv) Defecation, and (v) Area scan and move away (Schaller, 1976 and Pillai & Alexander, 1985).

TABLE NO. 1

All 13 herd with age differentiation and locality

S.No.	Herd No.	Total No. of Individual	Area (Locality)	A ♂	A ♀	SA ♂	SA ♀	J	Identification mark of herd
1.	GB-1 (AM)	5	Guda Bishnoian (Jodhpur)	4	-	1	-	-	1 ♂ having right half broken horn
2.	GB -2 (MH)	14	---do---	1	8	-	3	2	1 ♀ having not tail (cut at the base)
3.	GB -3 (MH)	9	---do---	1	5	-	2	1	- no mark-
4.	GB-4 (MH)	12	---do---	1	6	-	4	1	1 ♀ having no tail carriage
5.	GB-5 (AM)	9	---do---	8	-	1	-	-	1 ♂ having longest horn ≈ 12"
6.	A-1 (MH)	6	Alai (Nagpur)	1	3	-	1	1	- no mark-
7.	A-2 (MH)	24	---do---	1	15	-	5	3	Big sized ♂
8.	A-3 (AH)	6	---do---	4	-	2	-	-	- no mark-
9.	GE-1 (AM)	7	Gogelao Enclosure	5	-	2	-	-	Big horn - big sized ♂
10.	GE -2 (MH)	3	---do---	1	1	-	-	1	-no mark-
11.	S-1 (AM)	5	Satheran (Nagpur)	2	-	3	-	-	1 ♂ longer horned ≈ 10"
12.	S-2 (MH)	10	---do---	1	4	-	3	2	- no mark-
13.	S-3 (MH)	7	---do---	1	3	-	2	1	-nomark-
	Total	117		31	45	9	20	12	

AM – All male herd

A ♂ – Adult male

SA ♂ – Sub Adult male

J – Juvenile

MH – Mix herd

A ♀ – Adult female

SA ♀ – Sub Adult Female

GB – Guda Bisnoian

GE – Gogelao Enclosure

S – Satheran

A – Alai

Age differentiation is based on body size and horn length (Dunham, 1999).

Nilgai also defecates on the faecal heaps of Chinkara (Schaller, 1976) and these occasions were not uncommon during present study. Such total 11 heaps were observed in all at four study sites (6 Guda Bisnoian, 2 Gogelao Enclosure and 3 Alai).

The identification of own faecal heaps is generally made by antelopes through volatile pheromone secreted from pre-anal gland along with faecal material (Walther *et al.* 1983).

B. Bush Hitting by Horns:

When male observed some type of danger or any unknown person even observer too, in its locality, then it chose a big bush and scratched the horns with anger and power. Such scratched bushes were observed closely. No substance was noticed on such spots but barks of twigs were removed. According to Kumar (1993) and Walther *et al.* (1983) the scent marking glands, which are found just beneath each horn and opening of these glands just near the base of each horn, discharge some liquid.

This marking was observed on the peeled twigs of shrubs like, *Crotalaria burhia*, *Prosopis cineraria*, *P. juliflora*, *Maytenus* and *Balantidies*.

This type of behaviour was more common in the breeding season (Feb.-March and July –Aug.)

Total 33 such occasions were observed during present study in all 13 herds. This activity was mainly in males of both (all male and mixed herd) types of herds. 52 scratched bushes were also found which were not under direct observation (21 in Guda Bisnoian, 10 in Alai, 5 in Gogelao Enclosure and 16 Satheran). All scratched bushes were mainly on outer boundary of the territorial area.

C. Eye Rubbing on Twigs (Antorbital Marking):

Antelopes generally have a gland under the eyes, a character in which they differ from the oxen and goats. Outwardly this gland takes the form of a black vertical slit, nearly hairless skin. The slit opens into a deep hairlined, perforated pocket through which the secretion of the underlying gland is

released. This is an inguinal gland (pre-orbital gland) (Prater, 1971; Walther *et al.* 1983 and Schaller, 1976).

In year long study, 19 cases of direct observation were noted and 39 other such spots in different areas were also noticed. The eye rubbing activity was restricted to only mixed herds. During this process animal moved its head forward and backward and this set of movement may be regarded as one scent marking method. The marking involved either one or both sides of the head alternately, and repeated many times in succession at the same place. A black viscous semisolid solution was noticed on these twigs. This solution later on solidified. The chemical composition of this substance is not known.

Pillai and Alexander (1985) conducted such studies on blackbuck and observed that on approaching the object or site of marking these animals tilt their heads to one side and applies the gland on to the tips of the branch or stem or rubs the gland against a wall or fence.

D. Bed Site-Path Fixation:

In all antelopes a gland between the inter-digits (Pedal gland) is well developed and play a pheromonal gland role (Bourliere, 1954).

When members of a herd move in territorial area, they follow the first one and move in a single line after the first member (Bourliere, 1954). In present study specific paths were noticed at all the different sites. Before sitting, the animal first snuffed the ground then scratched the soil and later on sat on that place. Chinkara has pedal gland in front legs which release scent during scratching on soil particles (Bourliere, 1954). As such, in most cases each and every member sit at the same spot during resting period.

In 11 cases it was observed that all the members of the herd moved in single line from resting place to grazing site and vice-versa. In 69 cases it was noticed that, for rest every animal used the same spot. In Alai site it was noted that a specific female was found sitting at the same place on many occasions and similarly a marked male also followed same pattern in Guda Bisnoian.

Discussion

In year long study 334 cases of territory demarcation by gazelles were observed in different patterns. In some cases like Bed Site pattern, female also showed same pattern as male. Out of 334 cases, 33.23 % territory displaying method was only by Faecal Pellet Heaps. Then secondly they gave importance to Bush Hitting method (25.45%) and Bed Site-Path Fixation pattern (23.95%). Eye rubbing on twigs showed only 17.37 % out of 334 cases.

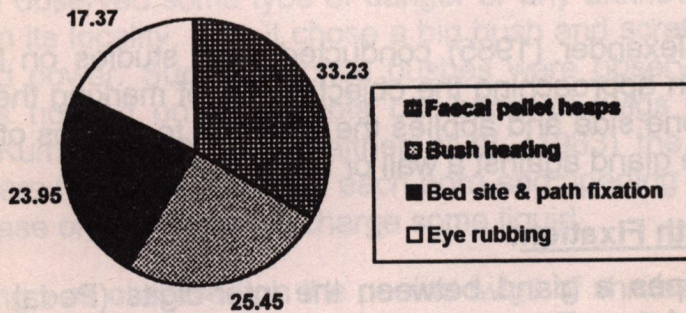


Fig. 1 : Graphical representation of territorial activity

These types of territory marking methods were also noticed in other mammals by various workers in different fields. Maximum studies were conducted on Faecal Heaps because many animals use these for "lekking" ground in breeding season. Many species use faeces to demarcate territories or home ranges (Brown & Mac Donald, 1985; Smith *et al.* 1989; Pigozzi, 1990; Estes, 1991; Ovaska and Davis, 1992). Faeces serve as a substance for glandular secretions and as visual "Signposts" (Ortmann, 1960; Asa *et al.*, 1985; Ranjitsinh, 1982). Faeces may be ideal substances for scent marking because they have a minimal energetic cost to the signaller (Gosling, 1981; 1985). They mark over the faeces and urine of females (Walther *et al.*, 1983; Moodie and Byers, 1989; Arcese *et al.*, 1995).

Very little information is available about the other methods for demarcation of the territory. However, Bush Hitting was also observed in Black buck by Kumar (1993) and many other species of antelopes by Walther (1964).

Eye Rubbing on Twigs was noted by Schaller (1976) in Thomson gazelle and in many mammals by Prater (1971) and in Gazelles and their relatives by Walther *et al.* (1983).

Bed Site-Path Fixation pattern was also observed in Black Buck by Kumar (1993) and Bourliere (1954). However, no such references are available on Indian Gazelle.

Indian Gazelle performed various types of methods for showing their presence in particular area, but the preferred method was Faecal Pellet Method. Activity preference is shown in Fig 2.

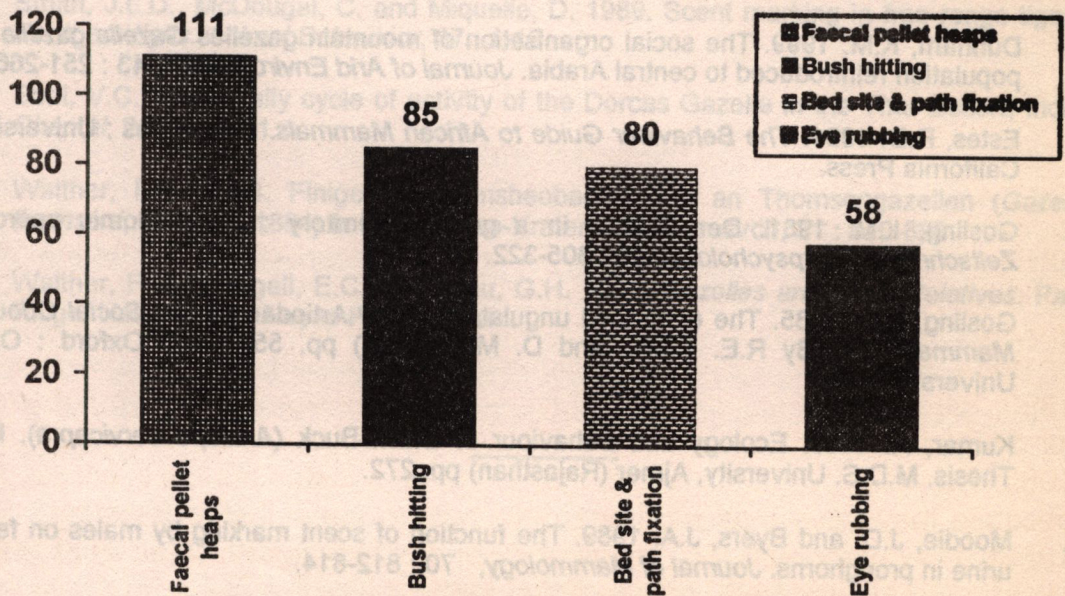


Fig. 2 : Activity preference in territorial demarcation

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References

1. Arcese, P.; Jongejan, G. and Sinclair, A.R.E. 1995. Behavioural flexibility in a small African antelope : the size and composition of oribi groups. *Ethology*, 99 : 1-23.
2. Asa, C.S.; Mech, L.D. and Seal, U.S. 1985. The use of urine, faeces, and anal-gland secretions in scent marking by a captive wolf (*Canis lupus*) pack. *Animal Behaviour*, 33 : 1034-1036.
3. Bourliere, F. 1954. *The Natural History of Mammals*. London.
4. Brown, R.E. and MacDonald, D.W. 1985. *Social odours in Mammals*. Oxford :Oxford University Press.
5. Dunham, K.M. 1999. The social organisation of mountain gazelles *Gazella gazella* in a population reintroduced to central Arabia. *Journal of Arid Environments*, 43 : 251-266.
6. Estes, R.D. 1991. *The Behaviour Guide to African Mammals*. Los Angeles : University of California Press.
7. Gosling, L.M. 1981. Demarkation in a gerenuk territory : an economic approach. *Zeitschrift fur Tierpsychologie*, 56 : 305-322.
8. Gosling, L.M. 1985. The even-toed ungulates : order Artiodactyla. In: *Social Odours in Mammals* (Ed. By R.E. Brown and D. MacDonald) pp. 550-618. Oxford : Oxford University Press.
9. Kumar, A. 1993. Ecology and Behaviour of Black Buck (*Antelope cervicapra*). Ph.D. Thesis, M.D.S. University, Ajmer (Rajasthan) pp. 272.
10. Moodie, J.D. and Byers, J.A. 1989. The function of scent marking by males on female urine in pronghorns. *Journal of Mammology*, 70 : 812-814.
11. Ortmann, R. 1960. Die Analregion der saugetierte. *Handbuch der Zoologie*, 3 : 1-68.

12. Ovaska, K. and Davis, T.M. 1992. Faecal pellets as burrow markers: intra-and interspecific odour recognition by western plethodontid salamanders. *Animal Behaviour*, 43 : 931-939.
 13. Piggozi, G. 1990. Latrine use and the function of territoriality in the European badger, *Meles meles*, in a Mediterranean coastal habitat. *Animal Behaviour*, 39 : 1000-1002.
 14. Pillai, L.K. and Alexander, K.M. 1985. Scent marking patterns of the Black buck. *Antelope cervicapra*. In : *Recent Trends in Ethology in India* (Eds. – M. Balakrishnan and K.M. Alexander). The Ethological Society of India Bangalore, pp. 169.
 15. Prater, S.H. 1971. *The book of Indian Animals*. B.N.H.S., Bombay, pp. 324.
 16. Ranjitsinh, M.K. 1982. Territorial behaviour of the Indian Black buck (*Antelope cervicapra*, Linnaeus, 1758) in the Velavadar National Park, Gujarat. *Jol. of B.N.H.S.*, 79 (2) : 241-246.
 17. Schaller, G.B. 1976. A note on a population of *Gazella gazella bennetti*. *Jol. of B.N.H.S.* 73 : 219-220.
 18. Smith, J.L.D., McDougal, C. and Miquelle, D. 1989. Scent marking in free range tigers, *Panthera tigris*. *Animal Behaviour*, 37 : 1-10.
 19. Soni, V.C. 1983. Daily cycle of activity of the Dorcas Gazelle in the Thar Desert, India. *Cheetal*, 24 (3) : 9-11.
 20. Walther, F.R. 1964. Finige verhaltensbeobachtungen an Thomsongazellen (*Gazella thomsoni*, Gunther, 1884) in Ngorongoro-Krater. *Z.F. Tierpsych.*, 21 : 870-890.
 21. Walther, F.R.; Mungall, E.C. and Grau, G.H. 1983. *Gazelles and Their Relatives*. Park Ridge, New Jersey : Noyes Publications.
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Studies of Tetrapodes of Bhojpur and Buxar Districts of Bihar

by

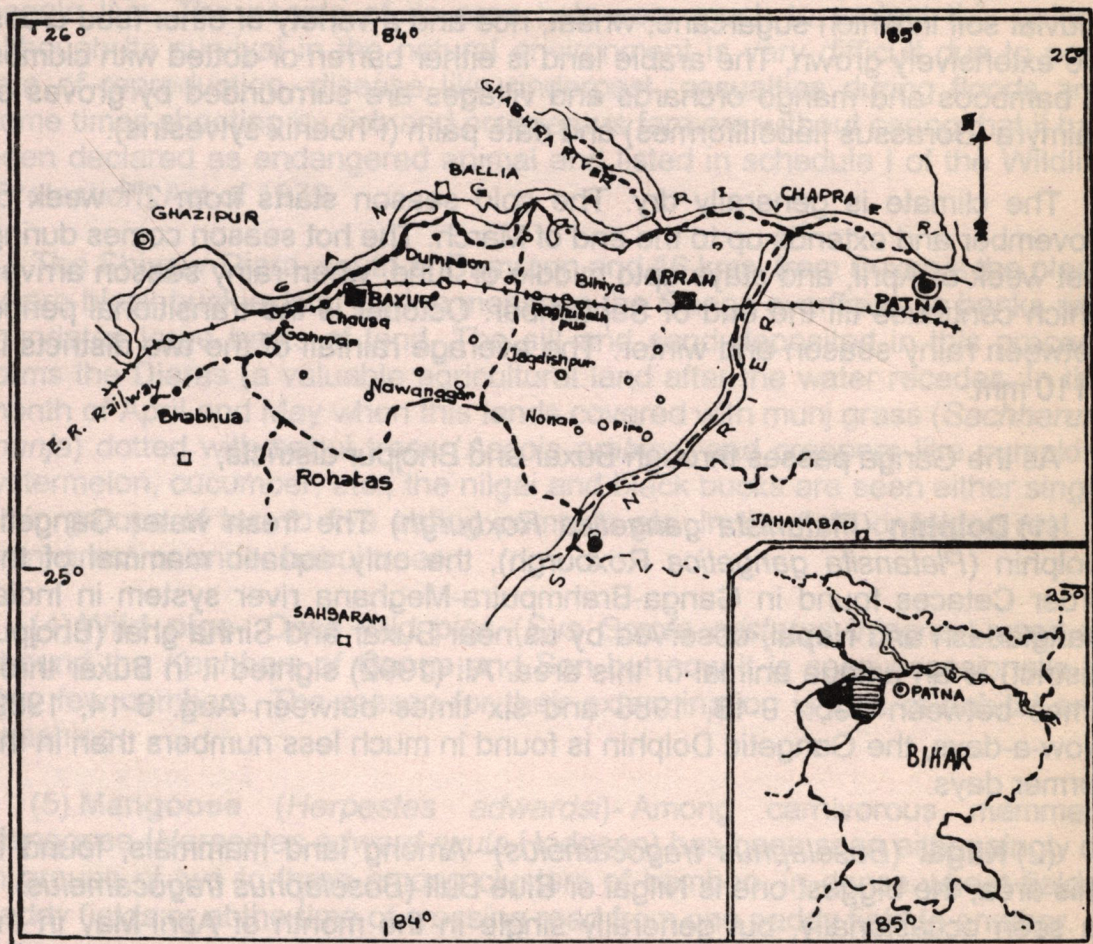
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When the faunistic surveys of Bhojpur district was performed by me in 1978, 1983 and 1984, the present Buxar district was part of it. Therefore, studies on tetrapodes of these two districts have been combined on the basis of specimens collected during surveys, observations made by us in the field and information obtained through local authorities and from previous records (Roychaudhury, 1966; Shashi, 1977 and Sinha, 1986).

Today's Bhojpur district (fig.1) is situated between $25^{\circ} 8'$, and $25^{\circ} 41'$ North latitude and $84^{\circ} 18'$ and $84^{\circ} 52'$ East longitude and Buxar district between $25^{\circ} 13'$ and $25^{\circ} 42'$ North latitude and $83^{\circ} 45'$ and $84^{\circ} 26'$ East longitude. The headquarters of Bhojpur and Buxar districts are Arrah and Buxar respectively.

Bhojpur and Buxar are adjacent districts. Bhojpur is bound on the west by Buxar and South-west by Rohtas district. On the north the boundary of both the districts is marked by the river Ganga which separates them from Gazipur and Balia districts of Uttar Pradesh and Saran district of Bihar. North-west portion of Buxar district is bound by Gazipur district of Uttar Pradesh and south-west by Rohtas and Bhabhua districts. On the east the boundary of Bhojpur district is marked by the river Son which separates it from Patna and Jahanabad districts and meets the Ganga at the north eastern corner of the district.

There are no natural lakes in these two districts but a number of tanks are scattered throughout. Some natural depressions do collect water during rainy season and one near Dumraon is the centre of attraction for migratory and local birds.



Forests are absent from both the districts but they are rich in highly fertile alluvial soil in which sugarcane, wheat, rice and a variety of other food crops are extensively grown. The arable land is either barren or dotted with clumps of bamboos and mango orchards and villages are surrounded by groves of palmyra (*Borassus flabelliformes*) and date palm (*Phoenix sylvestris*).

The climate is generally dry. The cold season starts from 2nd week of November and extends up to the end of March. The hot season comes during first week of April, and stays upto middle of June, when rainy season arrives which continues till the end of September. October is the transitional period between rainy season and winter. The average rainfall of the two districts is 1110 mm.

As the Ganga passes through Buxar and Bhojpur districts,

(1) **Dolphin** (*Platanista gangetica* Roxburgh) The fresh water Gangetic Dolphin (*Platanista gangetica* Roxburgh), the only aquatic mammal of the order Cetacea found in Ganga-Brahmaputra-Meghna river system in India, Bangladesh and Nepal, observed by us near Buxar and Sinha ghat (Bhojpur district) is a unique animal of this area. Ali (1992) sighted it in Buxar three times between Feb., 9-18, 1988 and six times between Aug. 6-14, 1989. Now-a-days, the Gangetic Dolphin is found in much less numbers than in the former days.

(2) **Nilgai** (*Boselaphus tragocamelus*)- Among land mammals, found in this area, the biggest one is Nilgai or Blue Bull (*Boselaphus tragocamelus*). It is seen occasionally, but generally single in the month of April-May in the wheat, pumpkin or pulses' field or under mahua tree (*Bassia latifolia*.)

(3) **Black buck** (*Antilope cervicapra rupicapra*)-Literally there is no Black buck (*Antilope cervicapra rupicapra* Muller) found within forest boundary of Bihar. It has managed to survive in the plains of Buxar and Bhojpur districts. As per information collected locally and through record, it is estimated that about 250 black bucks reside in intensely cultivated area of these districts. Small herds of two to six can be seen in rainy season, either grazing or taking rest in paddy fields. During winter, it can be found among crops of wheat and peas. According to Shahi (1977) Chausa (Buxar district) is the most suitable

place for the survival of black buck. It is the place where religious minded people live. The people of its area help very much to protect this animal although its survival in the natural environment is very difficult due to poor rate of reproduction, disease like rinderpest, casualties during floods and some times shooting by rich and prosperous farmers without caring that it has been declared as endangered animal and listed in schedule I of the Wildlife (Protection) Act of 1972.

The Shivpur Diara, south of Dumraon and 16 kms. from Buxar is the place where black buck exists. During monsoon the Ganga overflows its banks and inundates large tracts of land. The silt and sand deposited in this process forms the Diaras (a valuable agricultural land after the water recedes. In the month of April and May when this lands covered with munj grass (*Sachharum munja*) dotted with babul trees (*Acacia arabica*) and creepers like pumpkin, watermelon, cucumber, etc., the nilgai and black bucks are seen either singly or in groups of two to five eating pumpkin etc. in the field or taking rest in munj grass or under babul trees.

(4) **Wild pigs**- Once wild pigs (*Sus Scrofa cristatus* Wagner) used to abound the *Kachhars* of Ganga and Son but now it is seen occasionally in very few numbers. The reason for their extermination is loss of habitat and poaching.

(5) **Mongoose** (*Herpestes adwardsi*)- Among carnivorous mammals Mongoose (*Herpestes adward nyula* Hodgson) has been seen either singly or in groups of two to three among clusters of bamboo, in dense wheat fields, paddy fields or at the time of crossing road from one paddy field to another.

(6) **Jackal** (*Canis aureus indicus* Hodgson) is often seen coming out of Munj grasses in the evening. They come in villages in the night and do harm by invading various kinds of crops like maize, watermelon etc. and carrying away fowls, chicken and small domestic mammals from farmers' houses.

(7) **The Otter** (*Lutra* sp.) has been seen by villagers on the bank of ganga river. This animal is dependant for their food on aquatic animals.

(8) **Fox** (*Vulpes bengalensis* (Shaw) is often seen in the villages passing through mango orchards, after sun set in semi-dark.

(9) Today cat (*Paradoxurus hermaphroditus*, (Pallas) has been seen near houses in the village in dark mainly after dinner to eat the left over.

(10) Among primates Langurs (*Presbytis e. entellus* (Dufresne) and Rhesus Macaque (*Macaca m. mulata* (Zimmermann) were seen singly or in small groups on the branches of mango trees near Arrah and in guava orchards in Buxar.

(11) Indian hares (*Lepus nigricollis ruficaudatus* Geoffroy) was seen in both the districts coming out of the bushes in the evening.

(12) Among small mammals House rat (*Rattus rattus rufescens* (Gray), House mouse (*Mus musculus castaneus* Waterhouse) and Five striped squirrel *Funambulus penn anti* Wroughton) of the order Rodentia and House shrew (*Suncus murinus caeruleus* (Shaw) of the order Insectivora are very common throughout these districts.

(13) Among bats, Sinha (1986) recorded: Lesser Rat-tailed Bat (*Rhinopoma h. hardwickei* Gray) collected from Tari Mahalla Arrah. The colony was in old houses of Arrah city. The size of colony was more than 200 exs.

(14) Indian pouch-bearing Bat (*Taphozous longimanus* Hardwicke) was collected in mist net in the night set at Bintoli, Arrah.

(15) Indian False Vampire (*Megaderma l. lyra* Geffroy) was collected from abandoned rooms of a house of Dumaron Maharaj, Dumron (Buxar district). The size of the colony was about 500 exs.

(16) Indian Pipistrelles (*Pipistrellus c. coromandra* (Gray), Indian Pigmy Pipistrelle (*Pipistrellus mimus mimus* Wroughton), Dormer's Bat (*Pipistrellus dormeri* (Dobson), and Lesser yellow Bat (*Scotophilus kuhlii* Leach) were collected in the mist-net set at different places in Arrah town.

Among fascinating birds, the following were observed by us as :

- (1) House crow (*Corvus splendens* Vieillot)- very common
- (2) Jungle crow (*Corvus macrorhynchos* Wagler)- common
- (3) Treepie (*Dendrocitta vagabunda* (Latham)- very common
- (4) Indian Robin (*Saxicoloides fulicata* (Linnaeus)- common
- (5) Small Minivet (*Pericrocotus cinnamomeus* (Linnaeus)-common,
- (6) Indian Oriole (*Oriolus* sp.)- frequent,
- (7) Common Myna (*Acridethers tristis* (Linnaeus)- very common,
- (8) Brahminy or Black headed Myna (*Sturnus pagodarum* Gmelin)-common
- (9) Baya or the common Weaver Bird (*Ploceus philipinus* (Linnaeus)-common
- (10) The house sparrow (*Passer domesticus* (Linnacus)- very common,
- (11) Koel (*Eudynamys scolopacea* (Linnaeus)- frequent
- (12) Indian Cuckoo (*Cuculus micropterus*)- frequent
- (13) Crow Pheasant (*Centropus sinensis* (Stephens)- Occasional
- (14) Large Indian Parakeet (*Psittacula eupatria* (Linnaeus)- frequent,
- (15) Small Green Bee-eater (*Merops orientalis* Latham)- frequent
- (16) Common swallow (*Hirundo rustica* Linnaeus)- Common in villages on telegraph wire,
- (17) Roller or Blue Jay (*Coracias benghalensis* (Linnaeus)- Frequent in the open fields or on telegraph wire

- (18) Spotted Dove (*Streptopelia chinensis* (Scopoli))- frequent in pairs in open ground
- (19) Ring Dove (*Stroptopelia decaocto* (Frivaldszky))- frequent in pairs in open scrub
- (20) Blue Rock Pigeon (*Columba livia* Gmelin)- very common in villages and towns, often found in colonies in human habitation
- (21) Hoopoe (*Upupa epops* Linnaeus)- frequent in and around villages and towns.
- (22) Shikra (*Accipiter badius* (Gmelin)- found once in a grove of large trees
- (23) White Wagtail (*Motacilla alba* Linnaeus)- observed in the moist shallow gorund among small bushes in three to five numbers
- (24) Purple Sunbird (*Noctarinia asiatica* (Latham)- on Chinese rose flower in a garden in the town
- (25) Redvented Bulbul (*Pyenonotus cafer* (Linnaeus)
- (26) White checked Bulbul (*Pyenonotus leucogenys* (Gray)- sometimes in the flower gardern in the town
- (27) The great horned Owl (*Bubo bubo* (Linnaeus) among big trees garden in the dusk.
- (28) Common kite (*Milvus migrans* (Boddaert)- seen on the wing, turning, twisting and circling in the sky near human habitations
- (29) Bengal vulture (*Gyps bengalensis* (Gmelin)- seen in large gatherings at animal carcasses on the ground near natural depression containing water. Aquatic birds were also seen by us as:
- (30) Sarus Crane (*Grus antigone* (Linnaeus)- one seen in the paddy field

- (31) Cattle Egret (*Bubulcus ibis* (Linnaeus))- about ten in paddy field and about fifty on a tamarind tree in Arrah town
- (32) Pond Heron or Paddy Bird (*Ardeola grayii* (Sykes))- found mostly around shallow natural water pond near villages or towns.

Among ferocious but colourful reptiles,

- (1) Common Bark Gecko (*Hemidactylus leschenaulti* Dum. & Bibr.) was observed in the hollows and branches of mango trees and other big trees
- (2) Yellow-Bellied House Gecko (*Hemidactylus flaviviridis* Ruppell) is very common and found in every house in sufficient numbers. It is generally nocturnal but found also during day time.
- (3) Indian Garden Lizard (*Calotis versicolor* (Daudin) is very common and generally found on the fence and small flower trees in villages and towns.
- (4) Common Indian skink (*Mabuya carinata* (Schneider) is also very common among rocks and under woodlogs near houses. Sometimes it was also observed moving on bed.
- (5) The Indian Monitor (*Varanus bengalensis* (Linnaeus) has been seen on Babul trees in Dumaron in Bhojpur district.
- (6) The Common mud Kachuga (*Kachuga kachuga* Gray) is very common in canals near Sinha Ghat and was observed children playing with it.
- (7) The Gharial (*Gavialis gangeticus* Gmelin) and
- (8) The common Indian Crocodile or Mugger (*Crocodilus palustris* Lesson) have been seen by fishermen sometimes on the bank of Ganga near Sinha Ghat (Bhojpur district). According to Roy Chaudhury (1966) non-poisonous colobrids can be seen along with occasional *Naja* species but during survey we could not come across these reptiles.

Most common amphibian in these area is :

- (1) The Indian Bull Frog (*Rana t. tigrina* Daudin) along with
- (2) The common Indian Toad (*Bufo melanostictus* Schneider) which is found everywhere and produce a melodious sound during rainy season. Besides these;
- (3) The Paddy Field Frog (*Rana limnocharis* Schneider) was also found everywhere on both sides of roads in watery area of paddy field and
- (4) The skipping Frog (*Rana cynophyctis* Schneider) in the water course on both sides of road in different places.

Acknowledgement

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References

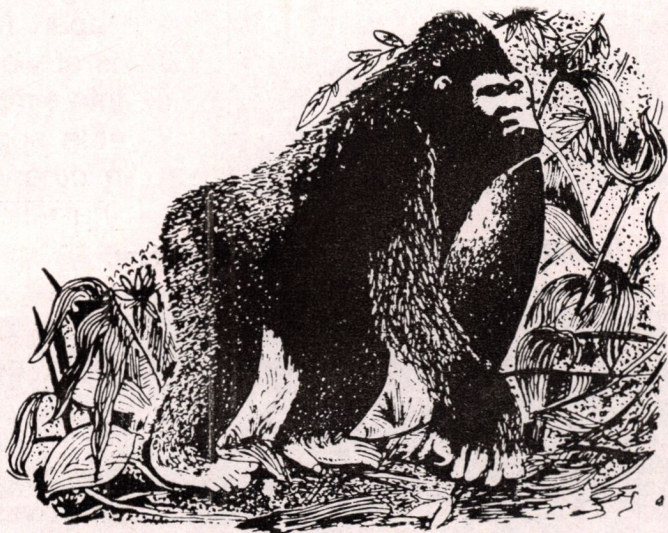
1. Ali, S.M. 1992. The Gangetic Dolphin. *My forest*, 28:245-250
 2. Roy Choudhury, P.C. 1966. Bihar district Gazeteers, Shahabad. Govt. of Bihar, Patna.
 3. Shahi, S.P. 1977. Back to the wall-Saga of wildlife in Bihar- India. New Delhi, Madras.
 4. Sinha, Y.P. 1986. The Bats of Bihar- Taxonomy and ecology. *Rec. zool. Surv. India*, Occ. Pap. 77. pp. 1-60, pl. 7.
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Plate : 1 The mother with her infant.



Plate : 2 The killer dog with its half-eaten prey.



Gorilla.

Gorilla

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The Gorilla is the largest of living primates and along with the two species of chimpanzee is closely related to man. Indeed fossils and biochemical data indicate that the chimpanzees and gorilla are more closely related to man than they are to the orang-utan. The fourth of the great apes and are probably the most intelligent land animals on earth apart from human, as judged by human standards. They can learn hundreds of words in deaf and dumb sign language and even string some together into simple grammatical two word phrases. Nevertheless the gorilla's formidable appearance, great strength and chest beating display have given it an otherwise unfounded reputation for untamable ferocity. Field studies show that wild gorillas are no more savage than any other wild animals. In Rawanda thousands of tourists approach on foot to within a few metres of totally untrained wild gorillas and not one of these visitors has ever been hurt. Adult males are dangerously aggressive only when threatened by man and also in defence of their breeding rights and female groups.

There are three races of gorilla found in two widely separated areas of Africa. The Eastern population is kept apart by the Zaire river as Gorillas do not readily swim and the nature of intervening terrain does not allow them to mix freely. The forest is dense and dark and beneath the high closed canopy very little ground vegetation grows, certainly not enough to support the predominantly terrestrial gorilla.

Gorillas are mainly terrestrial and quadrupedal. They walk on soles of their hind limb, but pivot on knuckles of their fore limb. However, some individuals particularly young ones spend much time on trees and occasionally adults make foraging trips into the forest canopy. Light weight individuals can be seen swinging from tree to tree to tree by their arms.

The gorilla differs from its alias relative, the chimpanzee in being much larger and in the different proportion of its body (larger arms, shorter and broader hands and feet) and in different colour pattern. Their build is much

heavier and many of the proportional differences are connected with this. In particular are the much larger teeth, especially the molars needed to sustain a huge hulk and much bigger jaw muscles, especially the temporal muscles. A small sagittal crest may occur in female gorillas or in chimpanzee but a big one meeting a big shelf of bone, the nuchal crest at the back of the skull, is a distinctive characteristic of male gorillas and considerably exerts external shape of the head. Gorilla has small ears and the nostril are bordered by broad expanded ridges (natal wings) which extend to the upper lip.

Gorillas are predominantly foliage eating animals, feeding mainly on leaves and twigs rather than fruits. The species of herbs, shrubs and vines that make up the gorillas diets grow best in secondary and montane forests where the open canopy allows plenty of light to reach the forest floor. Although found over a small area of Africa, gorilla habitat includes a wide range of altitudes, from sea level in West Africa to 3790 m in east.

Of the great apes (Family Pongidae) gorillas form the most stable grouping patterns. The same adult individuals travel together for months and sometimes at a time. It is because gorillas are mainly leaf eating and that is why they can afford to live in relatively permanent groupings large permanent groups owing to the abundance of foliage feed. It does appear that fruit eating limits group size in the gorilla's diet that in the east group sizes are about half those recorded for East Africa (the predominantly frugivorous chimpanzee and orangutan are mostly solitary).

The gorilla's large size and folivorous habits mean that the animals cannot regularly travel long distances and still find time to forage and digest their bulky diet. In fact because of the abundance of their food supply, under natural conditions they do not need to move very far in any one day to find enough to eat. Although the home ranges of gorilla groups cover 5.30 sq. km. depending on the region, the normal rate of travel is only 0.5-1 km. per day. Even with a range as small as 5 sq.km., a circumference of 8 km. would have to be patrolled where the area is to be defended. Gorillas are too large and travel too slowly to do this and thus there is no territorial defence. Consequently there is considerable overlap of the ranges of neighbouring groups and even overlap of the most used "core areas".

Gorillas never stay long enough at one feeding site to strip it completely rather they crop the vegetation leaving enough growth for rapid rejuvenation. They normally feed during morning and afternoon and rest for a few hours around midday. At night they make "nests" platforms or cushions of branches and leaves pulled and bent under them that protect them from cold, prevent them sliding down a steep hill slope or support them on a tree for the night. At higher altitudes in East Africa, gorillas defecate in their nests during the night, perhaps because it is too cold to leave them. However, the lack of fruit in the diet means that the dung is dry and does not soil their coats. By contrast, in West Africa, where the diet includes fruit, nests with dung in them are extremely rare.

Gorillas do not have a distinct breeding season. Births are usually single "as in the case of chimpanzee and orang-utan". In very rare cases twins are born and they are usually small at the time of birth. The mother, who has to carry the infants for the first few months of life, find it so hard to care for two that one invariably dies. New born infants weigh 1.8-2.3 kg and their grayish pink skin is sparsely covered with fur. They begin to crawl in about nine weeks and can walk 30-40 weeks. Gorillas are weaned at 2.5-3 years of age and females give birth at about four year intervals. However, 40 percent mortality rate in the first three years means that a surviving offspring is produced only about every 6-8 years in the breeding life of a female.

Female gorillas mature sexually at 7-8 years of age but usually do not start breeding until they are 10 years or so. Males mature a little later, but because of competition among them for females very few will start breeding at 15-20 years of age.

The size of gorilla groups varies from 2 to about 35 animals but usually numbers five to ten. An average group in the east (Rwanda, Uganda and Eastern Zaire) contains about three adult females, four or five offspring of widely different ages and one fully adult male called the "silverback" because of its silvery white saddle. Groups in West Africa average about five animals. Because groups effectively contain a silverback male, the difference is in the number of females and offspring. But the main contrast between the regions is seen not in average, but maximum group size. In the east 15-20 members

are not uncommon and some groups of over 30 animals have been recorded in Zaire.

The silverback is the most important individual for the cohesiveness of the group. Unlike the female of the most other social mammals, female gorillas leave the natal groups at puberty to join other troops. Having mostly originated from different group, the adult females in any one silverback's harem are, therefore, mostly unrelated, the social ties between them are weak and little difference of social status among the females is noticeable. In contrast to many other primates it is the bond between each female and the silverback, rather than bonds among females, that holds the group together. The attractiveness of the silverback to the females is most apparent during the mid-day rest period, when animals play (primarily youngsters), sleep or groom one another. Mutual grooming, which keeps them free from dirt and parasites and in an expression of affinity, is not as frequent in gorillas as in other social primates. When it does occur, it is usually between mother and offspring, adult female and silverback and sometimes immature and silverback, especially if the youngster is an orphan. Social grooming among adult females is rare. Most young adult males leave the group and travel alone— sometimes for years— until they acquire females from other groups and establish their own harem. These young silverbacks leave of their own accord rather than being driven out by the leading male. Aggression in gorillas is extremely rare and serious fights occur only when a group leader meets either another group leader or more usually a lower order silverback. Then the two males perform elaborate acts of threat. The famous chest-breathing display may be accompanied by hoots, barks and roars, tearing of vegetation and sideways dashes, all designed to intimidate the rival male and possibly also to impress and attract some of his nubile females.

In general females leaving their natal group are seen to prefer joining lone males or small groups, rather than large established groups. Lone males appear to be prepared to work harder for females than do leaders of established groups and, therefore, pose more of a threat to "resident leaders".

When females leave their natal group, they generally do not stay with the first male to whom they transfer. Many factors probably influence their choice.

One could be quality of the habitat in the male's range, but another is certainly the male's prowess in fights, which provide some indication to a female of the male's ability to protect her and her offspring against predators and other males. Protection against other males is important. About a quarter of infant deaths are due to infanticide by a male that is not infant's father. The most likely explanation for this is that an intruder male that kills a female's young offspring can mate with her and so begin to reproduce sooner than a male that does not practise such infanticide.

It appears that once a male has established successfully a breeding harem, he stays with it for life. With some males are in near permanent possession of females while others have none. Competition among males for females is intense and the severity of fights between males bear witness to this. Clearly, to some extent, large size is an advantage in these fights and in the displays that precede them. Inter male competition is thus almost surely one explanation for the sexual dimorphism (difference of body form between the sexes) in body size, canine size and jaw musculature shown by the gorilla. In this the gorilla matches most other polygamous mammal species. Given the competition between male and the necessity for the male of this slow moving terrestrial species to defend females and offspring, it is very probable that natural selection favours the survival of males with large canine. Certainly the gorilla is one of the most sexually dimorphic of all primate species, the males being almost twice as large as the females and moreover differently coloured.

The number of gorillas surviving in the world today is not known, for too little of their range has been surveyed. We have to make informed guesses and the best available estimate (1980) has at least 9000 in West Central Africa and 4000 in the East, of which only about 365 are mountain gorillas. Most of these are in danger as they and their habitat are disappearing and will continue to do so at an ever increasing rate. Gabon with three quarters of its land surface still covered by forest and its very sparse human population contains about half the western low land gorilla population and Zaire almost all the eastern one.

Throughout the gorilla's range in Africa, the forests on which it depends are being cut down for timber and begin converted into agricultural land. Deforestation did not matter because the human population was low enough for industrial development to practise shifting agriculture and the abandoned fields with their regenerating secondary growth, forest provided abundant food for the gorilla. As time passed, however, more clearing are becoming permanent features. Twenty-five years ago, gorillas lived in Nigeia. Now they are almost extinct there and cattle ranches cover what used to be gorilla habitat.

Another threat is hunting although it poses a minor problem compared to deforestation. Except in Uganda and Rawanda, Gorillas are killed for food and because they raid crops.

In West Africa gorillas are considered a crop pest throughout most of their range. Gorilla meat is consumed not only by the rural people but in Gabon, for example, it is served in the restaurants of main towns.

Zoo have also taken their toll. By the end of 1976, of 497 gorillas reported alive in captivity, 402 were caught in the wild and rest came from Cameroon.

For every gorilla reaching a zoo at least two die on the way. This figure of 402 shown above meas at least 1200 were taken from the wild. Although the trade has decreased markedly in recent years, the current price for young gorillas is lucrative enough to keep going the trade in animals for zoo.

Legislation to control hunting and capture of gorilla exists in all eight countries having wild gorillas population but only in Zaire the species is totally protected by law and in none other the laws are adequately enforced. At the time of writing, infant gorillas for sale, are still coming out of Zaire. While national parks or reserves that contain gorillas exist in all countries except the central African Republic, only about one third of roughly 29500 sq. km. of these reserved areas is suitable for gorillas habitat. Less than 5000 and probably only about 3000 gorillas actually live in national parks or reserves. Even in them, the gorilla cannot be considered safe. The trade in gorilla skull (sold to tourists as souvenirs) from the Virunga Volcanoes National Parks of Rawanda and Zaire, and the presence of villages and logging yard within

Gabon's Okanda National Park, illustrate this. Nor can the continued existence of the conservation areas themselves be guaranteed. In 1968, almost one fifth of the Virunga Volcanoes National Park, one of only two refuges for the rare Mountain gorilla, was appropriated for pryrethrum cultivation.

In all countries harbouring gorillas, it is extremely difficult for government to fund major conservation programmes given their other urgent priorities. Long-term ecological stability is usually sacrificed for short term economic gains, often with the active encouragement of international development organizations. If the gorilla is to be saved international conservation agencies must support existing reserves and fund extensive surveys in West Africa and Zaire to identify the most important areas of gorilla concentration which might then be turned into reserves. Ultimately, the local people must come to value gorillas and the forest in which they live. For the reason, funding of programmes for conservation, education and the development of tourism (whereby live wild gorillas become a source of income) are particularly important. Such programmes have recently been established successfully in Rawanda.

All this, however, is rather desperate rearguard action. In the long run, the well being both of gorilla and of its human neighbours will depend on curbing human population growth and increasing the productivity of agricultural land now available. Only these will check the increasing need for more land and the consequent destruction of the gorilla habitat.

The story of man's relationship with gorillas is shrouded in myth and legend (And horror movie King-Kong 1933). It was in 1954 that the Americans George and Kay Schaller began the first thorough study of gorillas by observing them from close quarters over a two-year period. This work set a pattern for future studies of these peaceable creatures and effectively buried the gorilla myth for good.

Taxonomic Account and Field Observations on the Biology of Hill Trout, *Barilius vagra Vagra* (Hamilton) in Doon Valley

by

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Abstract

In the present communication the common hill trout *Barilius vagra vagra* (Hamilton) an inhabitant of fast flowing rivers and streams of Himalaya, sub-Himalayan ranges, Yamuna, Ganga and is also found in Song river at Raiwala, Lacchiwala and Gularghati in eastern Doon Valley. The fish is a Columnn, surface and omnivorous.

Introduction

Hora and Mukerjee (1936) were the first to publish a systematic list of fishes of Doon Valley. Later the fish fauna of Doon Valley attracted the attention of Lal and Chatterjee (1962), Singh (1964), Grover (1970), Grover, *et al.* (1994), who contributed only in giving the systematic list of some fishes. However, biological studies remained neglected except for the work of Grover (1971, 79) on *Barilius bendelisis* and *Puntius ticto*. There are four species belonging to the family Cyprinidae out of which *B. vagra vagra* (Ham.) occur in fast flowing streams of Song river in the eastern part of the Doon Valley. Present investigation on the *B. vagra vagra* in Doon Valley is undertaken to study its taxonomy, observations and biology.

Material and Methods

The fishes were collected from Song river in three important localities (Raiwala, Lacchiwala and Gularghati) all the year round regularly at an interval of 15 days. The fishes were caught by the cast net, drag net,

sweeping net, tawning net, bag net, and in stagnant water the fishes were collected by hand.

Observations

In the present studies the fish varies from 5.2 to 7.6 cms. Body slender, moderately compressed, back nearly straight lined. The height of the body 5.2-6.0 times in the total length and 5.2-7.6 times in the standard length. The length of head 5.0-5.5 times in the total length and 3.9-4.2 times in the standard length. The length of snout 3.5-3.7 times in the length of head. The width of head 2.23-2.60 times in the length of head. Mouth supra-terminal, cleft of mouth prominent, lower jaw slightly larger. Barbels two pairs, maxillary very short, rostral about half as long as head. The diameter of the eye 3.5-4.3 times in the length of head and 1.72-2.0 times in the width of head. The inter-orbital width 3.2-3.23 times in the length of head. Dorsal originates near the caudal fin, midway between posterior border of the eye and root of caudal fin. Pectoral smaller than the head length. Anal originates just before posterior end of dorsal base. It is longer with 10-12 branched rays. Caudal fin deeply forked. Medium in size, 2-2½ rows between lateral line and base of ventral fin. Pre-dorsal scales 20. Lateral line scales 40-44. Lateral line complete. Silvery with ten bluish bars descending from back along the sides to the lateral line, fins yellowish, caudal margin gray.

Fin formula : D11/7, P1/15, V1/6, A11/10, C19, Li40-44, Ltr. 7½/4, Barbels 2 pairs.

1. Habit and Habitat

In hills, the habitat in which the fishes live, comprises fast flowing streams and turbulent rivers which flow over rocky or even sandy beds. The depth of the water may be shallow or deep depending upon the type of terrain along the stream. There are deeper pools at different sections of the same stream where majority of large sized fishes find convenient places for the movement and feeding. In the life of fishes the habitat structure plays a very important role in the discharge of the various life functions of the fishes.

B. vagra vagra occurs in the middle and upper strata of water of the perennial streams. It also prefers to live in stagnant and slow moving water

area of the streams. The fish assemble in shoals slightly below the surface. They are very lively swimmers and are seen to jump out of water during the afternoon.

Feeding Habits

Quantitative estimation of food was made by Pearses (1915) method. It is omnivorous and surface feeder. This species feeds more on animal food [Annelida (*lumricus*), nematoda, crustales (*cerdina* sps., *Eubbranchipus* sps., *paratephusa*), Nympha (*Beatis* sps., *Iron* sps., *Heptagenis* sps., *Epsorum* sps.), Nymphs (*Gomphidas*, *Cordulegastridae*) Larval (*Dinarthrum* sps., *Glosesosoms* sps., *leptocella* sps., *Limnophilus* sps.), **Himiptera** (*Gerridae* *Gerris* sps.)] than plant food [*Amphora* sps., *Cymbella* sps. *Fragilaria* sps., *Navicula* sps., *synedra* sps., *chlorella* sps., *chlamydomonas* sps., *Chara* sps., *Cladophora* sps.), *spirogyra* sps., *Ulothrix* sps. etc.].

Insect availability as food of these fishes is lowest during December, January, July and August and highest during October and November. The algae and diatoms are found in large quantities in March and then in August. The mouth is wide, the jaws and buccal cavity are edentulous. The buccal cavity is spacious. There is a filtering apparatus formed by the gill rakers which are small stumpy outgrowths and interdigitate with each other, forming a kind of sieve-like structure, preventing the escape of food through the gill slits. The posterior part of the pharynx is modified for crushing the food. This is a special adaptation for the food taken in by *Barilius vagra vagra* and compensates for the absence of the teeth from the jaws. The length of the alimentary canal in the size range 70-98 mm was found to range between 42 mm to 64 mm and relative length of the gut ranges between 0.56 to 0.666 times of total length. The size of the gut indicates that the fish is omnivorous.

Breeding Period and Behaviour

Breeding is an important physiological function performed by all living organisms. Hill stream fishes live under rigorous conditions of the fast flowing streams and have to face large number of difficulties in keeping progeny in tact. There are many problems involved in the breeding and upbringing of their young ones together with getting the proper type of reproductive impulse

at the right time. The maturity of gonads is invariably connected with the spawning impulse in these fishes. Majority of them get this impulse during the rainy season, when the temperature and other conditions of the streams are found most congenial by them.

The breeding period of the hill trout *B. vagra vagra* commences from July to September. The fish prefers quieter inundated areas by the sides of streams for spawning purpose where the gravid females lay eggs. The fish migrate up stream in shoals of 10-15 individuals in search of shallow spawning grounds. During breeding season, sexes are found to be disproportionate in the collection, the female far outnumbering the males. The males and females in the population have a ratio of almost 1:2. The occurrence of spent fishes from August to September leads to the conclusion that the spawning in this fish extends over a period of 3 months. When they have attained the size of 3 or 4 cm, they swim upward in shallow running waters in small groups. The smallest size at the first maturity for female is 85 cm and for male 96 mm. The diameter of ova is 1.5- 1.6 mm.

Acknowledgement

Thanks are due to officer-in-charge- Z.S.I., Dehradun for his cooperation in providing necessary documentation as and when required and thanks are due to the staff of Botany Department for identification of plants. Thanks also to Dr. S.K. Kulshrestha, Head of the Department of Zoology, D.A.V. (PG) College, Dehradun for providing facilities during present investigation.

References

1. Baloni, S.P. and Grover, S.P., (1982) : Fish fauna of Kedar Valley with notes on adaptation and ecology. **Indian Journal Forestry**, 5(2) : 131-37.
2. Day, F. (1878) : Fishes of India. Vol. 1, Tolyor and Francies, London.
3. Grover, S.P. (1970) : On the collection of fishes of the Song River in Doon Valley. **U.P. G.K.V.J. Sci. II** : 115-118.
4. Grover, S.P. (1971) : Some biological notes on *Barilius bendelisis* (Ham.) **Indian J. Fish**, 18 : 182-183.

5. Grover, S.P. (1979) : Field observation on the biology of *Puntius ticto* in Doon Valley. **Geobios**, 6 : 17-18.
 6. Grover, S.P., Aggarwal, B.S. and Rauthan, J.V.S. (1994) : Ichthyofauna of Doon Valley. **Him. J. Env. Zool.**, 8: 128-133.
 7. Hora, S.L. and Mukerjee, D.D., (1936) : Fishes of the Eastern Doons, United Provinces. **Rec. Indian Mus.**, 78 : 133-146.
 8. Lal, M.B. and Chatterjee, P. (1962) : Survey of the Eastern Doon fishes with certain notes on the biology, **J. Zool. Soc. India**, 14 (2) : 203-243.
 9. Pearse, A.S. (1915) : Quantitative estimation of food methods. **Bull. Wiss. Nat. Hist. Soc. Wail Waukee**, 13 : 7-22.
 10. Srivastava, Gopal Ji (1998) : *Fishes of Eastern Uttar Pradesh* Vishwavidyalaya Prakashan, Bhairovnath, Varanasi.
 11. Singh, P.P. (1964) : Fishes of the Doon Valley, **Ichthyological**, 2 : 86-92.
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Interspecific Interactions in *Macaca assamensis*

By

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Studies have been carried out on ecology and behaviour of Assamese monkeys (*Macaca assamensis*) in Darjeeling district, West Bengal for three years (1966-69). Most of the group of these hill monkeys have been sighted within an altitudinal range between 200-2600 m. Very often these monkeys have been noticed to interact with man and other animals. One such incident has been discussed in this paper.

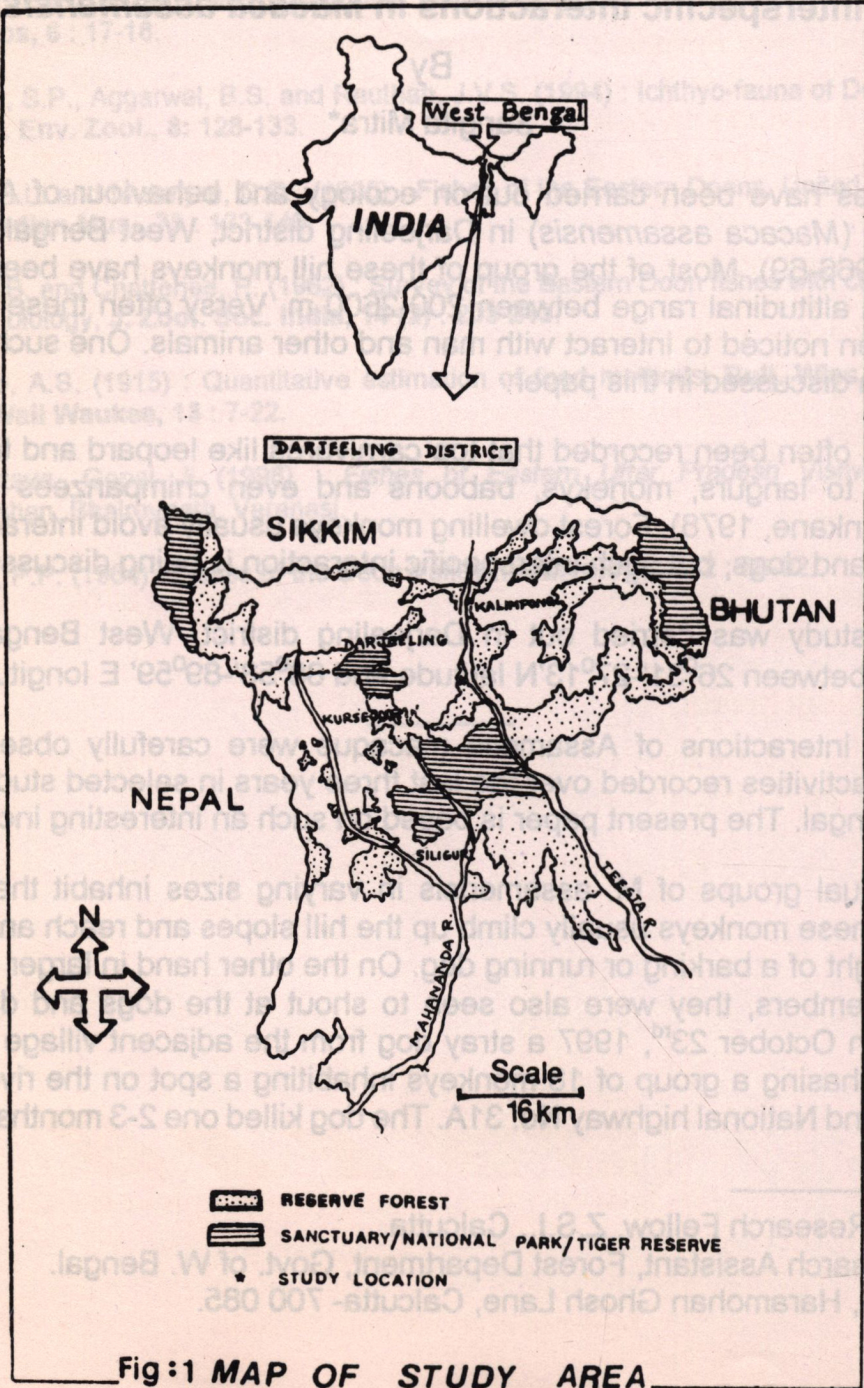
It has often been recorded that top carnivores like leopard and tiger pose a threat to langurs, monekys, baboons and even chimpanzees (Goodall, 1965; Kankane, 1978). Forest dwelling monkeys usually avoid interaction with humans and dogs, but such interspecific interaction is being discussed here.

The study was carried out in Darjeeling district, West Bengal (Fig.1) situated between $26^{\circ}31'-27^{\circ}13'N$ latitude and $88^{\circ}53'-89^{\circ}59' E$ longitude.

Daily interactions of Assamese macaque were carefully observed and general activities recorded over the last three years in selected study sites of West Bengal. The present paper is based on such an interesting incident.

Bisexual groups of *M. assamensis* in varying sizes inhabit these forest tracts. These monkeys usually climb up the hill slopes and reach any tree top at the sight of a barking or running dog. On the other hand in larger groups of 30-40 members, they were also seen to shout at the dogs and drive them away. On October 23rd, 1997 a stray dog from the adjacent village suddenly started chasing a group of 18 monkeys inhabiting a spot on the riverbank of Teesta and National highway No. 31A. The dog killed one 2-3 months old infant

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monkey and spent 35-37 minutes on taking its entire flesh and bones. Meanwhile, other members of the group started calling together, but none of them approached and saved the prey except an adult female (probably the mother), continued its loud intermittent calls from a tree top for the next one and half hour. The group retreated to the night resting site much earlier that day. They did not appear near the spot for the next 2 days.

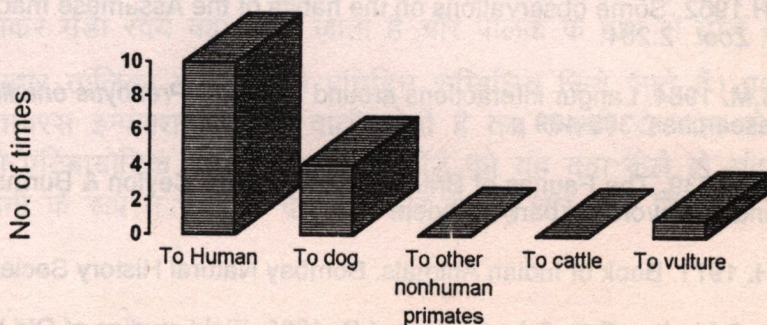
The above incident was consistent with the earlier observations n different nonhuman primates. Besides this, antagonistic and submissive responses have also been recorded between these monkeys and other animals sharing this habitat. Numbers of all these interactions have been noted for 7 successive days (taken as sample) and the results are presented here in the Fig. 2 and Fig.3.]

The results show that monkeys are more vulnerable to the hostility of other animals especially to human beings. During the above period, monkeys were attacked in 34 instances whereas harassment to other animals was recorded in only 15 cases.

Acknowledgements

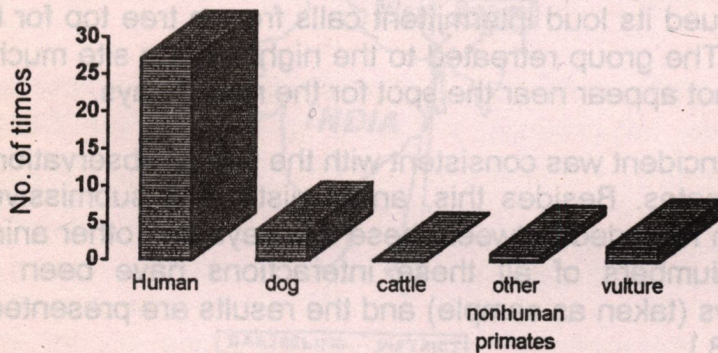
I thank the Director, Zoological Survey of India and Forest Deptt., Govt. of West Bengal for facilities and support.

Fig.2: Number of interspecific agonistic interactions in Assamese macaque



Directed to animals from monkeys

Fig.3: Number of interspecific agonistic interactions in Assamese macaque



Directed to animals from monkeys

References

1. **Blandford, W.T.** 1858-91 Fauna of British India, Mammalia XX +617p.
2. **Goodall, J.** 1965. Chimpanzees of the Gombe Stream Reserve. In: *Primate Behaviour. Field studies of monkeys and apes*, ed. By I. DeVore: 425-473 p.
3. **Haddow, A.J.** 1952. *Pro. Zool. Soc. Lond.* 122 (II) : 297.
4. **Kankane, P.L.** 1978. Studies on the Hanuman Langur *Presbytis entellus* (Dufresne) (Primates: Cercopithecidae) at Kanha National Park, M.P. *Proceeding of the workshop on wildlife Ecology*, Dehradun. 61-66 p.
5. **Khajuria, H.** 1962. Some observations on the habits of the Assamese macaque. *Proc. All India Cong. Zool.*, 2:284.
6. **Mohnot, S.M.** 1984. Langur interactions around Jodhpur (*Presbytis entellus*). In: *Current Primate Researches*: 399-409 p.
7. **Pocock, R.I.** 1939. The Faunas of British India including Ceylon & Burma. *Mammalia*, I. Primates and Carnivora (In part). London.
8. **Prater, S.H.** 1971. *Book of Indian Animals*. Bombay Natural History Society.
9. **Washburn, S.L., Jay, P.C. & Lancaster, J.B.** 1965. Field studies of Old World Monkeys and Apes. *Science*, 150: 1541-47p.

चिड़ियाघरों की शान— गेंडा

लेखक : रामेश बेदी*

पौष्टिक आहार

गेंडा शाकाहारी प्राणी है। प्रकृति में यह पेड़ों की टहनियां, कोंपलें, जड़ें, बेलें, घासों आदि खाकर गुजर करता है। चारा खाने में ऊपर का होंठ अधिक काम आता है, इसलिए वह बहुत मजबूत होता है। चारे को पकड़ने की सुविधा के लिए यह नुकीला बन गया होता है और निचले होंठ के ऊपर लटका रहा है।

दिल्ली के चिड़ियाघर में गेंडे के भोजन में घास, चोकर, चना, जई, सब्जियां, फल, वृक्षों की पत्तियां और कोमल शाखाएं रहती हैं। सुबह नौ बजे उसे सूखा आहार दिया जाता है जिसमें हरा चारा और पत्ते रहते हैं। हरे चारे में ज्वार, जई आदि की चरी 250 किलोग्राम और किसी पेड़ के ताजे काटे हुए पत्ते 100 किलोग्राम रहते हैं। पीपल, बरगद, जामुन, इमली आदि 30-35 प्रकार के पेड़ हैं जो इसके भोजन में काम आते हैं। राजधानी में इनमें से जो मिल जाता है वह छांग लिया जाता है। नीम की पत्तियों को यह इतने शौक से नहीं खाता।

हरे चारे के अलावा सुबह के भोजन में यह मिश्रण भी उसे दिया जाता है— भीगा हुआ चना डेढ़ किलोग्राम, गेहूं का चोकर डेढ़ किलोग्राम, जई या जौ डेढ़ किलोग्राम, गुड़ (केवल सरदियों में) आधा किलोग्राम, हल्दी पिसी हुई 50 ग्राम, नमक 50 ग्राम, फीड सप्लिमेंट 35 ग्राम, हड्डियों का चूरा (बोन मील) 35 ग्राम और औरोफेक 35 ग्राम। दोपहर ढाई बजे उसे खिचड़ी दी जाती है जिसमें ये चीजे डाली जाती हैं— चावल दो किलोग्राम, मूंग की दाल आधा किलोग्राम, अलसी के बीज 250 ग्राम, हल्दी 50 ग्राम और गुड़ आधा किलोग्राम।

गेंडे का पालक सुबह के सुखे भोजन-मिश्रण में से आधा बचा लेता है। उसे खिचड़ी में मिलाकर गोले बना लेता है। बाड़े के बाहर पालक जब गोले बना रहा होता है तब तसले की आवाज को सुनकर गेंडा स्वयं वहां पहुंच जाता है और पालक के हाथ से गोले खाता है।

गेंडे की आहार तालिका में छह केले प्रतिदिन सम्मिलित किये जाते हैं। पशुवाटिका में जब कोई बीमारी (वायरस इन्फेक्शन) फैलने वाली होती है तब उसकी रोकथाम के उपायों में सभी पशु-पक्षियों को एंटीबायोटिक दवा दी जाती है। गेंडे को यह दवा केले के अंदर रखकर खिला देते हैं। सावधानी के रूप में साल में दो-तीन बार इसका चार-चार दिन का कोर्स गेंडे को दे दिया जाता है।

तड़पती हुई मां मर गई

दिल्ली चिड़ियाघर में छह साल की एक भारतीय गेंडी थी। उसका नाम रोजी था। एक दिन उसके पालक ने चिड़ियाघर के मवेशी डॉक्टर को सूचना दी कि रोजी एक करवट पड़ी हुई है और उठती ही नहीं।

वह 14 महीने से गर्भवती थी। डॉक्टर ने समझा कि पहला ब्यात होने के कारण उसमें कैल्शियम की कमी हो गई है जिससे उसकी पिछली टांगें कमजोर पड़ गई हैं। लेकिन पांच दिन गुजर जाने पर भी जब वह नहीं उठी तब डॉक्टर ने गौर किया कि मूढगर्भ के कारण उसकी यह हालत बन गई है। जबर्दस्त पीड़ा ने उसकी पिछली टांगों को अपंग बना दिया था।

गर्भ स्थित बच्चे का पुट्टा बच्चेदानी के मुख पर अटका हुआ था। ऐसी स्थिति में वह कच्चे गर्भ को बाहर नहीं गिरा सकती थी। दो जून, 1986 की सुबह मूढगर्भ की पीड़ा से तड़पती मां मर गई और साथ ही उसका अजन्मा बच्चा भी मर गया। मूढगर्भ का शुरू में पता चल जाता तो सर्जन सिजेरियन ऑपरेशन करके बच्चे को निकाल देता और मां को बचा लेता।

मानसिक आघात से मृत्यु

1987 में दिल्ली चिड़ियाघर में बच्चे को जन्म देती हुई एक गेंडी मर गई थी। उसकी मौत के कारणों की समीक्षा करते हुए चिड़ियाघर के निदेशक ने बताया था कि प्रसव के समय बगल में एक तेज रफ्तार रेलगाड़ी धरती को धड़धड़ कंपाती हुई गुजर रही थी। उसका इंजिन पगले के समान तीखी चींखे मारता चला जा रहा था। इस भीषण कोलाहल से सामान्य आदमी की भी नाड़ियां उत्तेजित हो जाती हैं। प्रसव वेदना से बेचैन गेंडी इसे सहन नहीं कर सकी। मानसिक तनाव और उत्तेजना में मर गई।

लांस एजिल्स चिड़ियाघर में राधा नाम की एक गेंडी 19 बरस से रह रही थी। 2,500 किलोग्राम वजनी राधा का सींग चिड़ियाघर के फाटक की दरार में फंस गया और वह मर गई। यह बात नवंबर 1988 की है। अफसरों के ख्याल में वह मानसिक आघात से ही मरी थी।

युद्ध स्तर पर रोग से बचाव कार्य

लखनऊ चिड़ियाघर में 18 दिसंबर, 1983 की रात को एक गेंडी की मृत्यु हो गई थी। उसका नाम मेनावती था और उम्र आठ साल। उसके मरने का कारण स्पष्ट रूप से पता नहीं चला। चिड़ियाघर के पशु-चिकित्सकों ने समझा कि शायद सांप के काटने से मर गई है। किंतु इज्जतनगर (बरेली) के भारतीय पशु-चिकित्सा अनुसंधान संस्थान ने परीक्षणों के बाद जलभी

(rabies) रोग से मरने की रिपोर्ट दी थी। यह पहला मामला था जब कोई गेंडा इस रोग से मरा था।

मेनावती 13 दिसंबर को बीमार हुई थी। उसकी चाल लडखड़ाने लगी थी और उसके मुंह से लार बहने लगी थी।

जलभी रोग संसर्ग से फैलता है, खासकर रोगी की लार द्वारा। मेनावती के साथ एक नर गेंडा, हीरामन रहता था। इसके सेवक और पालक ने हीरामन को सदा की भांति अपनी बीमार संगिनी को चाटते हुए देखा था। इससे उसे जलभी रोग की चपेट में आने का खतरा था। जो कर्मचारी किसी भी रूप में मेनावती के संपर्क में आये थे वे भी इस घातक रोग के संभावित खतरे से बाहर नहीं थे। ऐसे कर्मचारियों की संख्या 25 थी। इन्हें और हीरामन को रोग की चपेट से बचाने के लिए युद्ध स्तर पर कार्य किया गया। स्थानीय बलरामपुर हॉस्पिटल के डॉक्टरों ने चिड़ियाघरों में ही शिविर लगा दिया। कर्मचारियों को 7 दिन तक जलभीरोधक (antirabies) इंजेक्शन लगाये गये और हीरामन को चौदह। हीरामन को इंजेक्शन लगाने की विशेष प्रकार की पिचकारी लखनऊ में उपलब्ध नहीं थी। उसे भारतीय वन्य प्राणी संस्थान, देहरादून से मंगाया गया था।

चिड़ियाघरों में तथा जंगलों में भी कुछ पक्षी गेंडों की पीठ पर बैठे, उसके शरीर पर शरण पाने वाले पराश्रयियों को चुगते रहते हैं। ये पक्षी गेंडे के अच्छे मित्र हैं। इससे गेंडे को दो लाभ होता है—एक तो पराश्रयियों से मुक्ति और दूसरा यह कि ये पक्षी किसी भी अजनबी को देखकर उड़ जाते हैं, गेंडे को यह सावधान हो जाने का संकेत मिल जाता है।

हाथी से यदि सामना हो जाय तो गेंडा उससे डरता नहीं। कहा जाता है कि यह उसकी टांगों के नीचे घुसकर उसके पेट पर चोट करने की कोशिश करता है। प्लीनी (23-78 ईस्वी पश्चात्) ने लिखा था कि हाथी के साथ लड़ने से पहले यह पत्थर पर रगड़कर सींग को तेज कर लेता है।

चिड़ियाघरों में संतति

कलकत्ता में 1933 से, शिकागो में 1948 से, काहिरा में 1949 से तथा व्हिप्पेनेड (ब्रिटेन) और वाल्से (स्विट्जरलैण्ड) में भी गेंडे रखे गये हैं।

चिड़ियाघरों में जलवायु, भोजन और परिस्थितियों में परिवर्तन आ जाने से गेंडे के प्रजनन पर भी प्रभाव पड़ सकता है।

कलकत्ता के अलीपुर चिड़ियाघर में गेंडे का एक जोड़ा सफलतापूर्वक जोड़ा नहीं बना सका। चिड़ियाघर के अधीक्षक इसे सात बरस तक गौर करते रहे। उनका कहना था कि नर और मादा कभी भी एक साथ गरमी में नहीं आये। यदि मादा गरमी में आई होती थी तो नर ठंडा होता था और जब नर कामासक्त होता तब मादा ठंडी होती थी। संयुक्त राज्य अमेरिका के डॉक्टर डिल्लन रिटले का भी ऐसा ही विचार था। शिकागो चिड़ियाघर में नौ सितंबर, 1949 को मादा गरमी में देखी गई। गरमी की यह अवधि कुल तीन दिन तक रही। इस चिड़ियाघर में नर और मादा अलग-अलग रखे जाते हैं क्योंकि उन्हें मिलाने के पहले जो तीन प्रयत्न किये गये थे उनमें वे लड़ने लगते थे।

गेंडी सारे साल हर 46 से 48 दिनों में एक बार गरमी में आती रहती है। गरमी की अवधि कुल तीन दिन रहती है। इस अवधि में नर उसके साथ जोड़ा बना ले और गर्भ ठहर जाय तो वह फिर गरमी में नहीं आती। मादा के समान पर भी कुछ समय के लिये गरमी में आता है। जब दोनों गरमी में हों तभी शारीरिक संबंध हो पाते हैं।

प्रेयसी के लिए नाक का श्रृंगार गंवा बैठा

लखनऊ चिड़ियाघर में रानी नामक एक अपूर्व सुंदरी गेंडी थी। असाधारण रूप-यौवन से संपन्न रानी को कामदेव के शर अपना लक्ष्य बनाने में सफल नहीं हो पाये थे। वह गरमी में नहीं आती थी। इसका एक कारण यह था कि वह अकेली ही थी। उसकी गेंडे से कभी मुलाकात नहीं हुई थी। चिड़ियाघर के निदेशक ने रानी के रतिविलास के लिए एक वर तलाश किया। कानपुर चिड़ियाघर के इस बलिष्ठ गेंडे के विनिमय में दिल्ली चिड़ियाघर ने दो तेंदुए दिये थे। गेंडे की प्रगाढ़ प्रणय लीला में सहमागी बनाने की तैयारी में रानी को अतिरिक्त पौष्टिक खुराक दी गई थी जिससे वह जोड़ा बनाने के लिए तैयार और स्वस्थ बन जाए।

वाल्से चिड़ियाघर में 1942 की गरमियों में एक मादा भेजी गई थी। उसे नर के साथ वाले बाड़े में रखा गया था। नर ने उसमें कुछ दिलचस्पी दिखाई। अगला कदम यह था कि एक ही बाड़े में उन्हें एक साथ ले आया जाय। जब ऐसा किया तब मादा नर पर लपकी। उस पर हमला करके उसे जख्मी कर दिया। इस पर उन्हें अलग कर दिया गया। नर के उसी घेरे में मादा को हर रोज एक बार दाखिल किया जाता। इससे मादा की हमलावर आदत धीरे धीरे कम हो गई। चिड़ियाघर के अधिकारियों ने भी धैर्य नहीं छोड़ा। आखिर एक दिन ऐसा आ ही गया जब मादा अपने साथ नर की उपस्थिति स्वीकार करने लगी।

लंदन के चिड़ियाघर में 1964 में एक भीमकाय नर गेंडा लाया गया। कंधे पर यह लगभग 158 सेंटीमीटर ऊंचा था। नाक के सिरे से पूंछ की जड़ तक 3.15 मीटर था। अगस्त 1970 में इस नर को एक मादा के बाड़े के साथ वाले बाड़े में रखा गया। इन्हें एक-दूसरे से अलग

रखने के लिए बीच में लोहे के सरियों की एक बाड़ खड़ी थी। दस अगस्त को नर ने बाड़ के नीचे वाली आड़े रूख की छड़ के नीचे अपना सींग अड़ाकर उसे बार-बार उठाने के प्रयत्न किये। जोरदार दबाव से सींग जड़ से टूट गया और आंगन में गिर पड़ा। सींग के उखड़ने की चोट से बहुत खून बहा, गेंडा बहुत परेशान था और ऊंचा गरज रहा था। कुछ ही दिनों में जख्म भर गया। नया सींग उगना शुरू हो गया। एक साल में यह चार सेंटीमीटर लंबा हो गया। इस उदाहरण से नर में कामवासना का जाग्रत होना था। संभवतः इसके साथ ही मादा भी गरमी में रही हो। लेकिन दुर्भाग्य है कि पालकों ने दोनों को मिलाने की कोशिश नहीं की।

मासूम शिशु से जुदाई

चिड़ियाघरों में जब इनकी ठीक तरह देखभाल की जाती है तब वहां इनकी संतति बढ़ती रहती है। बंदी-जीवन में गेंडे के प्रसव के उदाहरण मिल जाते हैं। काजीरंगा नेशनल पार्क से पकड़ी हुई एक गेंडी 1961 के मध्य जून में कलकत्ता से जापान भेजी जाने वाली थी। अलीपुर चिड़ियाघर में कठघरे के अंदर ही उसने एक बच्चे को जन्म दे दिया। अब प्रश्न यह उठा कि बच्चे को भी क्या मां के साथ ही जापान भेज दिया जाय ? बच्चे की यात्रा का किराया तथा यात्रा में उस कोमल शिशु के कष्टों का और ऐसी ही अनेक बातों का विचार करते हुए उसे मां से अलग कर अलीपुर चिड़ियाघर में ही रखने का निश्चय किया गया। एक मास की आयु के भोले बच्चे के वियोग में ही उसकी मां रानी को विदेश यात्रा के लिए अकेला रवाना होना पड़ा।

नियमित प्रजनन

मैसूर चिड़ियाघर में भारतीय और अफ्रीकी गेंडे बच्चे देते रहे हैं। वहां 13 फरवरी, 1968 को एक बच्चा पैदा हुआ था। भारतीय एक सींग वाले गेंडे का एक जोड़ा नियमित रूप से संतति बढ़ा रहा था। पहले ब्यातों में पैदा हुए इसके दो नर बच्चे पश्चिम जर्मनी के चिड़ियाघरों को भेज दिये गये थे। जुलाई 1975 में इस जोड़े ने फिर एक मादा बच्चे को जन्म दिया था।

मई 1979 में मैसूर चिड़ियाघर में मदर मेरी नामक मादा अफ्रीकी काले गेंडे ने एक मादा बच्चे को जन्म दिया था। इसका नाम पार्वती रखा गया था।

मैसूर चिड़ियाघर के अलावा स्विट्जरलैंड के वास्ले चिड़ियाघर में भी भारतीय एक सींग वाले गेंडे का नियमित प्रजनन हो रहा था। 1975 तक वास्ले में भारतीय गेंडे के पांच बच्चे पैदा हो चुके थे।

जून 1979 में दिल्ली चिड़ियाघर में पहली बार अफ्रीकी काले गेंडे के प्रजनन में सफलता मिली थी। बच्चे का नाम जुम्नन रखा गया था। इसका भार करीब 35 किलोग्राम था। जुम्नन

के माता-पिता भी अफ्रीकी नस्ल के काले गेंडे थे। भारतीय गेंडे के बदले में ये अमेरिका के ओल्काहामा नगर चिड़ियाघर से दिल्ली आये थे। मूलतः यह जोड़ा मोम्बासा (अफ्रीका) का था।

कलकत्ता के अलीपुर चिड़ियाघर में 17 मार्च, 1924 को गेंडों ने जोड़े बनाना शुरू किया। महीने के अंत तक वे जोड़ा बनाते रहे। इनका बच्चा नौ अक्टूबर, 1925 को पैदा हुआ। इस उदाहरण में गर्भधारण काल लगभग साढ़े अठारह महीने रहा। दुर्भाग्यवश यह समय से कुछ पहले पैदा हो गया था जिस कारण बच्चा कुछ घंटे ही जिंदा रहा। इसलिए गर्भधारण का पूरा समय 19 महीने माना जा सकता है (जर्नल, बॉम्बे नेचुरल हिस्ट्री सोसाइटी, दिसंबर 1952)।

काजीरंगा में गेंडे के बच्चे अक्टूबर के महीने में पैदा होते हैं। काजीरंगा में जोड़ा बनाते हुए चार उदाहरणों से पता चलता है कि जंगली अवस्था में इनका संवेशनकाल (जोड़ा बनाने का समय) दो महीने है जो फरवरी के अंत से शुरू होता है और अप्रैल के अंत तक चलता है।

22 अप्रैल 1952 को काजीरंगा में एक मरा हुआ बच्चा पाया गया जो अभी-अभी पैदा हुआ था। रेंज ऑफिसर को संदेह था कि उसकी मौत जन्म के तुरंत बाद मां के पैरों द्वारा कुचले जाने से हुई है। पूंछ को छोड़कर उसके शरीर की लंबाई 1.20 मीटर तथा ऊंचाई 60 सेंटीमीटर थी।

दांपत्य जीवन

पालतू ढोरों तथा वन्य-मृगों से गेंडे का दांपत्य जीवन भिन्न होता है। उनके समान इसमें बहुपत्नी प्रथा नहीं देखी जाती। नर-गेंडे के हरम में एक ही पत्नी होती है।

संवेशन के समय कामासक्त गेंडे अपनी प्रेयसी के नितंबों को तथा सींग की नोक को स्पर्श करने में सुख मानते हैं। जंगल में संवेशन के चार उदाहरण, फरवरी के अंत से अप्रैल के अंत तक देखे गये हैं।

फैंक पोपेल्टन ने अफ्रीका में काले गेंडे को जोड़ा बनाते हुए देखा था। नर एक बार मादा के ऊपर कूदा, पर उसने इनकार कर दिया। दूसरे प्रयास में वह कामयाब हो गया। 1961 में कौलिन विल्लॉक ने टांगानीका में करीब एक किलोमीटर दूर से गेंडों को जोड़ा बनाते हुए देखा। ऊबड़-खाबड़ इलाके में मोटर दौड़ाते हुए वे उसके नजदीक पहुंचे। रास्ते में कुछ समय तो लगा ही, वे फिर भी कामकेलि में लगे रहे। कौलिन के पहुंचने के बाद भी वे 20 मिनट तक तो अवश्य कामकेलि में लगे रहे होंगे। दुर्भाग्यवश 11 सिंहों का एक लेहड़ा उधर आ गया जिन्हें देखने के लिए विल्लॉक की पत्नी अधिक उत्सुक थी। इसलिए वे इस मैथुन के बारे में अधिक

बातें नहीं बता सके। इस मैथुन में एक खास बात यह थी कि एक किशोर नर-गेंडा सारे समय पास ही मौजूद रहा।

जोड़ा बनाने से पहले प्रतिद्वंदी नर गेंडों में कई बार ज़िंदगी और मौत की जबर्दस्त भिड़ंत ठन जाती है। इसमें एक योद्धा गंभीर रूप से जख्मी हो सकता है या मर भी सकता है। शाकाहारी पशुओं में सामान्य रूप से मादाएं नहीं लड़ा करतीं लेकिन मादा गेंडों को आपस में लड़ते देखा गया है। जोड़ा बनाने के मौसम में नर गेंडा कुछ समय के लिए एक मादा के साथ मिलता है और उसके साथ संभोग करने के बाद अलग रास्ते पुर चला जाता है।

वयस्क गेंडी तीन या चार साल में एक बार गर्भधारण करती है। 16 से 17 महीने तक बच्चा मां के गर्भ में रहता है। कुछ प्राणि-शास्त्रियों ने यह अवधि 19 से 22 महीने तक बताई है। परंतु नेपालियों का विश्वास है कि गर्भधारण करने की कुल अवधि सामान्यतः एक साल होती है। मादा गेंडा साल के किसी भी समय बच्चे को जन्म दे देती है। एक बार 22 अप्रैल को जंगल में एक नवजात बच्चा मरा हुआ मिला था। एक ब्यात में एक ही बच्चा पैदा होता है। जन्म के समय बच्चे का भार लगभग 60 किलोग्राम और लंबाई 105 सेंटीमीटर होती है। एक बार पेट चीरकर गर्भाशय में से बच्चा निकाला गया था जिसके सब अंग बन चुके थे। इसका भार 58 किलोग्राम था और लंबाई 124 सेंटीमीटर थी।

मां से संरक्षण

बहुत छोटी उम्र में जब उसे जीवन की विकट अवस्थाओं में संघर्षमय जीवन अपनाने योग्य बनाया जा रहा होता है, गेंडे का बच्चा अपनी मां के साथ रहता है शिशु की रक्षा करने में मां बड़ी चौकस रहती है। उसे अपनी दृष्टि से ओझल नहीं होने देती। घास चरते समय वह मां के आगे-आगे रहता है। यही बात अफ्रीकी सफेद गेंडे में देखी जाती है जो भारतीय गेंडे के समान ही घास चरने वाला है। ये दोनों जातियां घनी ओर ऊंची घास वाले जंगलों में रहती हैं जहां अफ्रीका में तो सिंह से और भारत में बाघ से बचाने के लिए शिशु को आगे रखने की आदत पड़ गई है। शेर छोटे बच्चे को ही मार सकता है, बड़े गेंडे को मारना उसके बस में नहीं है। दूसरी ओर कौपलों को कुतरकर खाने वाले गेंडों की जातियों में बच्चों को आगे रखने की सावधानी बरतना आवश्यक नहीं होता क्योंकि ये ऐसे जंगलों में रहते हैं जहां वृक्ष और घास घने नहीं होते, छितरी और छोटी झाड़ियों में चरता हुआ गेंडा दूर से ही खतरे को देख सकता है। अफ्रीकी काले गेंडे के शिशु अपने मां-बाप के पीछे चलते हैं। काफी बड़ा हो जाने तक बच्चे को मां-बाप का संरक्षण मिलता रहता है।

भारतीय गेंडे का बच्चा अपनी मां के साथ कम-से-कम तीन से चार साल तक रहता है और अफ्रीकी काले गेंडे का बच्चा दो साल। गेंडे की अन्य एशियाई जातियों की संतानें नये बच्चे का

जन्म होने तक मां के साथ रहती हैं। बच्चा चार साल तक मां का दूध पीता है। एक इलाके में कई सारे गेंडों की मौजूदगी और उनके ऊपर एक प्रमुख नर द्वारा किए जा रहे नियंत्रण से लगता है कि वे एक यूथ बनाकर रह रहे हैं। अफ्रीकी काले गेंडे में और एशियाई गेंडो की तीन जातियों में ऐसा सरल, सामाजिक संगठन नहीं दिखाई देता।

मां से अलहदा होने का समय बच्चे की जिंदगी में बहुत नाजुक वक्त होता है। चार-पांच साल की उम्र के नर बच्चे को मां का रक्षात्मक परिवेश छोड़ना पड़ जाय तो वह कभी-कभी दूसरे प्रौढ़ नर के संग रहने लगता है नर-नर की संगत काफी समय तक जारी रह सकती है। अनुभव और आत्मविश्वास प्राप्त कर लेने तक छोटा बच्चा प्रौढ़ के रक्षात्मक साये में रहता है।

गेंडे की पांच जातियों में केवल अफ्रीकी सफेद गेंडे की जीवन-शैली में सामाजिक ढांचा नजर आता है। घास के मैदानों में ये लगभग एक दर्जन के झुण्डों में रहते हैं। इस जाति के नरों में अपने इलाके स्थापित करने की प्रवृत्ति होती है। प्रत्येक नर औसत लगभग 200 हेक्टर इलाके में अपनी प्रमुखता बना लेता है। अपने राज्य में वह अल्प-व्यस्कों तथा बूढ़े नरों की मौजूदगी को बर्दाश्त कर लेता है क्योंकि वे उसकी अधीनता को स्वीकार करते हैं। बच्चे वाली प्रौढ़ मादाएं बच्चों के साथ एक इलाके से दूसरे इलाके में घूमती-फिरती हैं। प्रौढ़ नरों का इलाके में प्रवेश बर्दाश्त नहीं किया जाता है।

दूसरे देशों में मांग

इतिहास में भारतीय गेंडे को पकड़कर बाहर भेजे जाने के अधिक रिकॉर्ड नहीं मिलते। यूरोप में सबसे पहला भारतीय गेंडा सोलहवीं शताब्दी के शुरू में भेजा गया था। पश्चिम भारत में खंभात के शासक ने इसे 1515 में पुर्तगाल के राजा को भेंट स्वरूप दिया था। गोआ से यह जहाज में चढ़ाया गया था। सोलहवीं शताब्दी के एक लेखक टोप्सेल ने अपनी एक पुस्तक में इसका चित्र दिया है। लेकिन अजीब बात यह है कि चित्रकार ने अपनी कल्पना से इसके कंधे में से उगता हुआ दूसरा सींग भी दिखा दिया है। जबकि भारतीय गेंडे में एक ही सींग होता है।

पुराने जमाने में मिस्र, यूनान और रोम में जो गेंडे ले जाए गए थे वे बहुत संभव है कि अफ्रीकी सफेद गेंडे थे जो नीलोटिक सूडान से लाए गये थे। क्लिओपेट्रा को हराने के बाद ऑगस्टस ने अपनी विजय के समारोह में दो सींग वाले अफ्रीकी गेंडे को प्रदर्शित किया था। हिपपोपोटोमस के साथ 39 ईस्वी पूर्व यूरोप में ले जाया गया यह शायद पहला अफ्रीकी गेंडा था।

ग्रीक ऐतिहासिक क्टेसियस (400 ईसा पूर्व) ने गेंडे का वर्णन किया था। पाश्चात्य देशों में यह शायद सबसे पहला ऐतिहासिक उल्लेख है जिसमें गेंडे को भारत का पशु बताया है। यूरोप में सबसे पहला गेंडा रोम में देखा गया था। सीजर के जमाने में जनता का मनोरंजन करने के लिए एक जिंदा गेंडा रोम में लाया गया था। प्लीनी ने इस पशु का जिक्र किया है। वह इसे एक सींग वाला प्राणी लिखता है जिससे मालूम होता है कि यह एशिया की जाति होगी। उसके कुछ काल बाद पेरिप्लस के लेखक ने भी गेंडे का वर्णन किया है।

1518 में स्पेन के राजा को एक जिंदा गेंडा समुद्र के रास्ते भेजा गया था। इंग्लैंड में सबसे पहला जीवित भारतीय गेंडा 1685 में पहुंचा था। कुछ साल बाद लगभग तीन साल की उम्र का एक गेंडा यूरोपीय महाद्वीप पहुंचा। यह पहले हार्लैंड लाया गया। वहां से उसे एक जुलूस में सारे महाद्वीप में घुमाया गया। वह जिस गाड़ी में सवार था उसे 20 घोड़े खींच रहे थे। आम लोगों की भीड़ उसे देखने के लिए खिंची चली आती थी। पढ़े-लिखे लोगों ने भी इसमें खूब दिलचस्पी दिखाई थी। उस जमाने के साहित्य में इसके बारे में लिखा गया था।

चिड़ियाघरों का गौरव

दुनिया के प्रमुख चिड़ियाघरों में इस लुप्तप्राय जंतु को स्थान दिया जा रहा है और यह चिड़ियाघरों का गौरव समझा जाता है। चिड़ियाघरों में गेंडे सामान्यतः मस्त, आलसी, लापरवाह तथा भदे दीखने वाले जानवर होते हैं और दर्शकों में जरा भी दिलचस्पी नहीं दिखाते। अपने क्रिया-कलापों से ये दर्शकों का दिल बहलाव भी नहीं करते। इन्हें देखते ही पुराने युग के भीमकाय जंतुओं की याद आ जाती है इसलिए ये बड़ी जिज्ञासा की दृष्टि से देखे जाते हैं।

दुनिया के अनेक भागों में भारतीय गेंडे की मांग है। दूसरे महायुद्ध के बाद असम सरकार संसार के विभिन्न चिड़ियाघरों को गेंडे भेजती रही है। असम से गेंडे प्राप्त करने वाले प्रमुख देश और नगर हैं : लंदन, शिकागो, वाशिंगटन, बर्लिन, हेमबर्ग, पेरिस, टोकियो, फिलेडेल्फिया, ब्राजील, मिलान और काहिरा। भारत में मुंबई, हैदराबाद, कलकत्ता, चेन्नई, मैसूर, तिरुअंतपुरम, लखनऊ, दिल्ली, गुवाहाटी आदि को असम सरकार ने गेंडे दिये हैं।

नई दुलहिन जैसा स्वागत

दूसरे देशों में जब ये पहुंचते हैं तब इनका किस उत्साह से स्वागत किया जाता है, इसका विवरण हम अमेरिकन रिपोर्टर के 27 दिसंबर, 1963 के अंक से यहां दे रहे हैं :

अमेरिका की राजधानी वाशिंगटन में जब मादा गेंडा पहुंची तब उसका उसी तरह स्वागत किया गया जैसे भारत में नववधू का किया जाता है। उस समय वायु सेना का एक जनरल, सेना के अफसर और सैनिक तथा बहुत से उत्सुक पत्र-प्रतिनिधियों की पलटन उपस्थिति थी।

उस मादा गेंडे ने जब पहला फोटा खिंचवाया तब वह सूखी घास चबा रही थी। इसकी खबर वाशिंगटन पोस्ट के मुख पृष्ठ पर इस बड़े शीर्षक के साथ छपी : असम की दुर्लभ मादा गेंडा दीपाली का आगमन।

एक सींग वाली दीपाली का वनज 1,350 किलाग्राम था। उसे एक साल पहले असम के काजीरंगा संरक्षित वन-प्रदेश से पकड़ा गया था। उसे उसकी आठ महीने की बच्ची राजकुमारी के साथ भारत सरकार ने अमेरिका के लोगों को भेंट किया। उनका नया घर वाशिंगटन का राष्ट्रीय जंतु संग्रहालय था। तीन साल पहले भारत सरकार ने उसी चिड़ियाघर को एक नर-गेंडा दिया था जिसका नाम तरुण था।

अमेरिकी वायु सेना का सी-130 परिवहन विमान दीपाली और राजकुमारी को लेकर कलकत्ता से 13 दिसंबर को रवाना हुआ था जो प्रलयकाल के लिए सुरक्षित प्राणियों वाले जलयान-सा प्रतीत होता था।

इन गेंडों को अमेरिका पहुंचने की कठिनाई का अनुभव इसी बात से हो सकता है कि वाशिंगटन में हवाई जहाज को खाली करने में ही दो घंटे लग गए। दीपाली के बक्से को एक मोटे तार के जरिये नलों पर लुढ़काकर एक खुले ट्रक पर चढ़ाया गया। फिर उसे ट्रैक्टर की मदद से दूसरे ट्रक पर चढ़ाकर अमेरिकी पुलिस की निगरानी में चिड़ियाघर पहुंचाया गया।

दिल्ली के दूल्हे के लिए गुवाहाटी से दुलहिन

1983 में दिल्ली चिड़ियाघर में गेंडे का एक जोड़ा था जो बूढ़ा हो गया था। इसके अलावा वहां गेंडे का एक मादा बच्चा था जो 1980 में चण्डीगढ़ के छतबीर चिड़ियाघर में पैदा हुआ था। इसका अकेलापन खत्म करने के लिये एक नर बच्चे की तलाश की गई। गुवाहाटी चिड़ियाघर में यह मिल गया। इसकी उम्र छह साल थी। इसका नाम आगि था। इसकी कीमत दो लाख पचास हजार रुपये असम सरकार ने दिल्ली चिड़ियाघर से लिए थे।

दिल्ली चिड़ियाघर से आगि को लेने जो दल गुवाहाटी गया वह अपने साथ काफी मात्रा में चावल, उड़द, नमक और गुड़ ले गया था। आगि के लिए उन्होंने ताजी खिचड़ी बनाई। गेंडे के बच्चे शौक से खिचड़ी खाते हैं। गुवाहाटी से आगि ने मालगाड़ी के डिब्बे में मीटर गेज पर यात्रा की। लंबी यात्रा तय कर 3 फरवरी, 1983 को वह सकुशल दिल्ली पहुंच गया।

आज्ञाकारी मोहन

दिल्ली के चिड़ियाघर में मोहन नाम का एक बलिष्ठ गेंडा था। उसकी देखने की शक्ति क्षीण थी। उसके बारे में वन्य प्राणियों पर डॉक्युमेंटरी फिल्में बनाने वाले नरेश बेदी ने मुझे

बताया था। 1967 में वह काजीरंगा अभयवन गये थे। अभयवन के बाहर बसे कुछ कबाइलियों के साथ उन्हें स्थानीय गांवों और जंगलों में घूमने का मौका मिला था। एक गांव में उन्हें बताया गया था कि मोहन गेंडा ब्रह्मपुत्र के पार एक गांव के खेतों में घूमता हुआ आ गया था। गांव के लोगों ने उसे पत्थर मारकर भगाने की कोशिश की। इधर काजीरंगा के अधिकारियों तक इसका समाचार पहुंचा। उन्होंने इसे अत्यंत क्षीण दृष्टिवाला पाया और पकड़कर दिल्ली भेज दिया।

इस क्षेत्र में गेंडे फसल को अकसर नुकसान पहुंचाते हैं। गांव वाले उन्हें खेती से खदेड़ते हैं। दिल्ली चिड़ियाघर में आने के बाद भी मोहन की नजर अधिक कमजोर होती गई। सामान्यतः यह शांत गेंडा था। पर कभी-कभी खतरनाक जीव बन जाता था। चिड़ियाघर में रहने वाले शाकाहारी प्राणियों के बाड़े में उनके पालक बेखटक घुस जाते हैं। वे प्राणी अपने पालक को पहचानते हैं और भिन्नता का व्यवहार करते हैं। परंतु मोहन के बारे में यह बात आंशिक रूप से ही लागू होती थी। चारा देने के लिए पालक पूरे, भरोसे के साथ उसके बाड़े में नहीं जाता था। यह पालक को पहचानता था, क्योंकि खाने के समय यह पालक के आदेशों का मजे से पालन करता था। ठीक उसी तरह जैसे खुरली पर भोजन के लिए खड़ी भैंस अपने मालिक के कहने को मानती है। मोहन के ऊपर के होंठ पर हाथ मारकर वह उसे सिर ऊपर उठाने को कहता था जिससे सानी के गोले आसानी से उसके मुंह में डाले जा सकें।

इसके रहन-सहन की आदतों का चित्रण करने के लिए एक बार मुझे इसके कुछ फोटो लेने थे। 1961 की 28 फरवरी थी। उस समय यह बाड़े के बीच में खड़ा मजे में टहनियां खा रहा था। मौका पाकर मैं चुपके से बाड़े की दीवार पर चढ़ गया। मैं फोटो लेने की तैयारी कर ही रहा था कि उसने मेरी गंध पा ली। गेंडे की देखने की शक्ति इतनी तेज नहीं होती, लेकिन सुनने और सूंघने की शक्ति अत्यधिक तीव्र होती है। आहार छोड़कर मोहन मेरी ओर बढ़ा। उसकी चाल बहुत धीमी थी। यद्यपि उसके पहुंचने से बहुत पहले ही मैं नीचे कूद गया था, परंतु वह मेरे खड़े होने के स्थान तक आया और वहां सूंघता हुआ—सा कुछ देर तक खड़ा रहा। मालूम होता है कि उसने हवा को सूंघकर निश्चय कर लिया कि मैं वहां नहीं हूं और तब वह वापस अपने स्थान पर गया और फिर खाने में लग गया।

शोर से बेचैनी

शोर से मोहन बहुत बेचैन हो जाता था। गरमियों में, मैं मोहन को खाई के अंदर उतरकर उसे पानी में अधिकांश समय गुजारते हुए देखता था। एक बार उसके बाड़े के साथ निर्माण का कुछ काम शुरू हुआ। ट्रकों द्वारा माल की ढुलाई हो रही थी। ट्रक की आवाज सुनकर मोहन पानी से निकलता और आवाज के पीछे भागता। ट्रक से पत्थर की रोड़ी के गिरने की आवाज तो उसे बिल्कुल ही सहन न होती। सिर ऊंचा उठाकर तथा नथुने फुलाकर उस दिशा की ओर

से आती हुई हवा को सूँघता हुआ और शब्दों को सुनता हुआ वह खतरे की भयंकरता का अंदाज करता।

रेलिंग, दीवार और गहरी खाई की बाधाएं उसे अपने इरादे पूरा न करने देतीं। इससे वह आपे से बाहर हो जाता। गुस्से में वह बाड़े के अंदर ही भागता और चक्कर लगाता हुआ पेंडों से भी टकरा जाता। मैंने देखा कि इस भगदड़ में उसकी थूथनी और मोटी चमड़ी पर छोटे-छोटे घाव भी हो गये थे। अपने भारी शरीर को उठाकर जब वह कूदता हुआ सा भागता और उसके नथुनों से निकलने वाले निःश्वास सुनाई देते तब वह भयंकर जीव प्रतीत होता। जब तक रोड़ी गिरने की आवाज उठती रहती वह बुरी तरह बेचैन रहता। ट्रक जाने के बाद वह पुनः खाई में घुस जाता।

इसी तरह लाउडस्पीकर की आवाज से भी यह भड़क उठता था। 1965 में बच्चों के लिए बनाये गये बाल चिड़ियाघर के उद्घाटन के अवसर पर लाउडस्पीकर ने जब काम करना शुरू किया तब वह बेहद बिगड़ गया था।

लंदन की पशु-वाटिका में किये गए परीक्षण बताते हैं कि गेंडा किसी भी प्रकार के संगीत को पसंद नहीं करता।

बरसात की बाढ़ में आजादी की तलाश

1961 की बरसात में मोहन के संबंध में एक अजीब अनुभव हुआ था। भारी वर्षा के कारण दो अगस्त को पशु-वाटिका एक झील सरीखी हो गई थी। चारों ओर पानी ही पानी फेल गया था। पानी के बढ़ते हुए साम्राज्य से वाटिका के कर्मचारियों की मुसीबत और अधिकारियों की चिंता का ठिकाना न था। मोहन को यह बढ़ता हुआ साम्राज्य मुक्ति का संदेश लाता हुआ प्रतीत हुआ। उसने जब अपने घेरे के छोटे तालाब को पानी से लबालब भरते हुए आसपास की खाइयों से एकाकार होते देखा तब सोचा कि यही मौका है जब वह मुक्ति पा सकता है। धीरे धीरे आगे बढ़ता हुआ वह पानी से भरी खाई तक पहुंच गया। सुबह चार बजे वाटिका के कर्मचारियों ने उसे देखा। उसके पालक ने उसे बार बार पीछे लौटने को कहा, पर व्यर्थ। करीब 20 आदमियों ने एक घंटे की कोशिश के बाद उसे अंदर भेजने में सफलता प्राप्त की।

श्याम सुंदरी की बगावत

दिल्ली के चिड़ियाघर में अफ्रीकी नस्ल की एक गेंडी थी। उसका नाम वीना था। वह दिल्ली चिड़ियाघर में ही पैदा हुई थी। जवानी में कदम बढ़ाने पर उसके श्यामवर्ण के बदन में निखार आ गया था। वह प्रजनन के योग्य हो गई थी जिससे अधिक आकर्षक और खूबसूरत बन गई थी। चिड़ियाघर में गेंडों के पालक उसे श्याम सुंदरी कहने लगे थे।

जानवरों की अदलाबदली कार्यक्रम के अधीन 1989 की मध्य जनवरी में उसे अमेरिका के ओकलहामा चिड़ियाघर भेजा जा रहा था। उसकी हवाई यात्रा के लिए लकड़ी के फट्टों को जड़कर एक मजबूत पिंजरा बनाया गया। यह साढ़े चार मीटर लंबा, डेढ़ मीटर चौड़ा और सवा मीटर ऊंचा था। श्याम सुंदरी की उम्र आठ साल थी। उसकी उम्र, वजन और ताकत का विचार रखते हुए मजबूत पिंजरा बनाया गया था।

बोझा ढोने वाली लौरी में श्याम सुंदरी का पिंजरा लादा गया। विदेश यात्रा के लिए उसे चिड़ियाघर से इंदिरा गांधी अंतर्राष्ट्रीय हवाई अड्डे ले जाया जा रहा था। आहिस्ता आहिस्ता सरकती हुई लौरी के आगे पीछे चिड़ियाघर के अफसर और कर्मचारी वाहनों में जा रहे थे। नई दिल्ली की पॉश कॉलोनियों से गुजरता हुआ यह काफिला किसी विशिष्ट व्यक्ति की अगुआई का जुलूस लगता था। श्याम सुंदरी महत्वपूर्ण बन गई थी।

कुछ गेंडों को शोर से सख्त नफरत होती है। दिल्ली की सड़कों पर उठने वाला कोलाहल प्रदूषण की अधिकतम सीमा को लांघ जाता है। चिड़ियाघर के बड़े फाटक से निकलकर लौरी जब मुख्य सड़क पर पहुंची तभी से चारों ओर उठने वाले शोर से श्याम सुंदरी के कान फटने लगे। पर वह लाचार थी। चुपचाप बर्दाश्त करती रही। अपनी नाराजगी जतलाने के लिए बीच बीच में हुंकार देती थी। बस।

इंसान का पागलपन बर्दाश्त नहीं हुआ

डिफेंस कॉलोनी के इलाके से श्याम सुंदरी का काफिला धीरे धीरे बढ़ रहा था। एक जगह रास्ता जाम था। मालवाही ट्रकों ने पूरी क्षमता से भोंपू बजाने शुरू किये। उनकी आवाज सीधा श्याम सुंदरी के कानों से टकराती थी। उसके कान फटे जा रहे थे। इंसान के पागलपन को अधिक बर्दाश्त करने का धैर्य उसमें खत्म हो गया। वह भड़क गई। कटघरे के अंदर उछलने कूदने लगी। उसे तोड़कर भाग निकलने की कोशिश करने लगी।

विदेश यात्रा के लिए अच्छे अच्छे लालायित रहते हैं। पर काली सुंदरी ने जैसे गोरों के देश में जाने के खिलाफ बगावत कर दी थी। वह इस हद तक नाराजगी प्रकट कर रही थी कि लौरी पलटने का खतरा नजर आने लगा था। ड्राइवर को अचानक ब्रेक लगाना पड़ा। अचानक गाड़ी का झटका लगने से वह अधिक परेशान हो गई। लौरी के रूकते ही सैकड़ों तमाशबीन इर्द-गिर्द जमा हो गये। वे श्याम सुंदरी को कटघरे के साथ जूझते हुए देख रहे थे। उसके हमले भयंकर थे। आजाद होने की राह में उसे मामूली सी कामयाबी मिली। उसने दो-चार फट्टे चटका दिये।

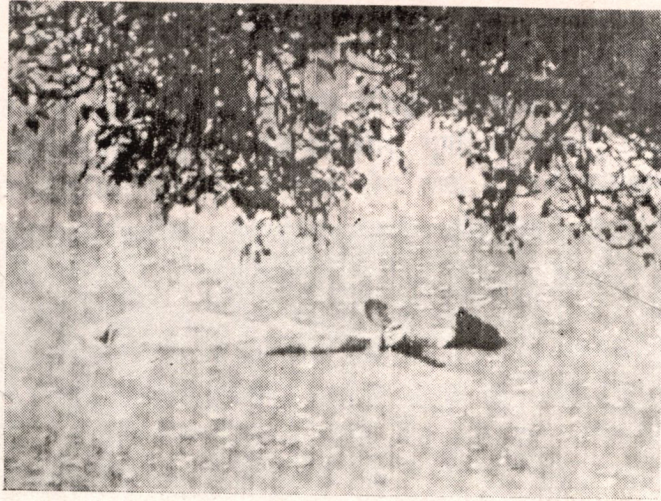
इस जंगली ताकत को देखकर तमाशबीनों के होश गायब हो गये। वे तुरंत भाग खड़े हुए। उनके मन में गेंडे के छूट जाने का भय समाया था। उसे उन्होंने मूर्त रूप दे दिया, अफवाह फैला दी कि एक गेंडा छूट भागा है और सड़कों पर अवारा घूम रहा है। मालूम नहीं वह किधर रुख अखत्यार कर ले। उसके सामने जो पड़ेगा उसकी खैर नहीं। भले शहर के अमनपसंद नागरिकों में दहशत से अफरातफरी मच गई।

जंगली ताकत पर दुलार की दस्तक

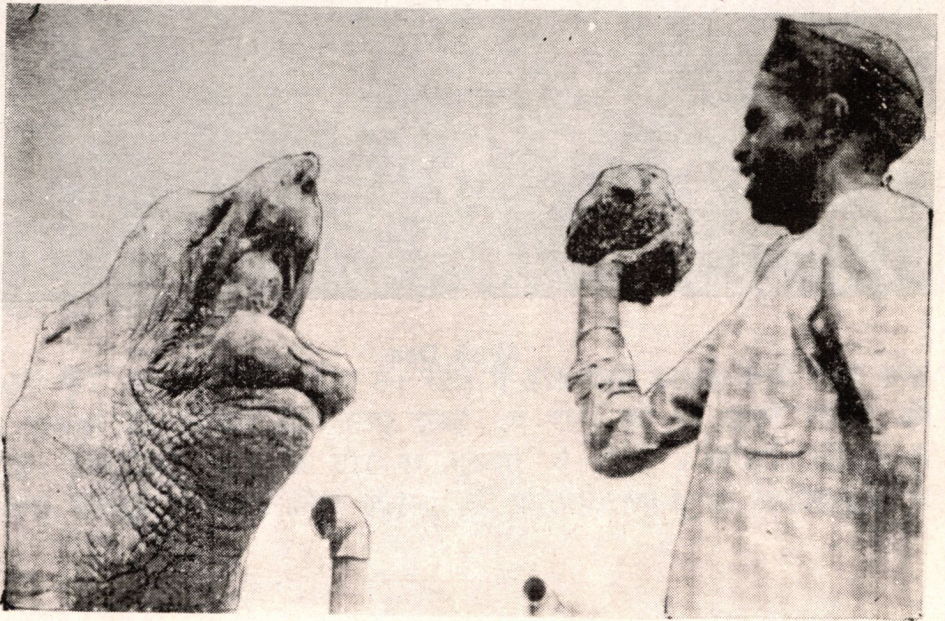
श्याम सुंदरी अच्छे स्वभाव वाली गेंडी थी। चिड़ियाघर में रखवाले के साथ उसका बरताव सहयोग का रहता था। वह उसके आदेशों का पालन करती थी। जवानी के तकाजे के कारण वह महीने में एक या दो बार 'गरमी' में आया करती थी। उन दिनों वह तुनुकमिजाज हो जाया करती थी। उस समय उसे नर गेंडे के साथ जोड़ा बनाने की जरूरत होती थी। चिड़ियाघर वालों के लिए यह कठिनाई थी कि उनके पास अफ्रीकी नस्ल का नर गेंडा नहीं था। ओकलहामा में उसके अनुरूप एक गेंडा मौजूद था जिससे उसकी शादी कराने की योजना बनाई गई थी। वैसे ओकलहामा की यात्रा के दौरान वह 'गरमी' में नहीं थी।

यात्रा से पहले वह अपना पूरा भोजन खाकर तृप्त हो चुकी थी। उसने 75 किलोग्राम चारा, 15 किलोग्राम अनाज-दाल का मिश्रण और एक दर्जन केले खाये थे। उसके एक दिन के भोजन पर करीब 60 रुपये खर्च होते थे।

खतरे से निबटने के लिए बचाव के सभी स्रोतों को बुला लिया गया। पुलिस दल फौरन मौके पर पहुंच गया। उसने इलाके को घेर लिया। दिल्ली चिड़ियाघर के 20 लोगों की मदद के लिए कोई 30 पुलिस वाले जुटे रहे। इनमें दो इंसपेक्टर और 6 सब इंसपेक्टर थे। जंगली जानवरों को पालने और उन्हें वश में रखने का सबसे बड़ा गुरु स्नेह है। चिड़ियाघर में वीना के रखवाले मनीराम ने इस गुरु-मंत्र को सिद्ध कर रखा था। उसने श्याम सुंदरी के साथ स्नेह से बातें करनी शुरू कीं। उसे प्यार भरी थपकियां दीं। उसका मनपसंद आहार अनाज-दाल का मिश्रण और केले खिलाये। इस तरह उसके मिजाज को शांत किया। इसके बाद उसे सही-सलामत चिड़ियाघर में वापिस ले आया गया। उसका सड़क-नाटक करीब तीन घंटे चला होगा। उसकी अमरीका यात्रा एक हफ्ते के लिए टालनी पड़ी।



जोहड़ में लेटा हुआ गेंडा



सानी का लड्डू खाने के लिए मोहन मुंह खोल देता था ।



Musk Deer.

कस्तूरी मृग विलुप्ति की ओर

लेखक— नवीन खण्डूरी*, डा. एस.पी. सिंह**

लगभग 2200 मीटर से 4300 मीटर तक की ऊँचाई पर पाया जाने वाला हिमालय का यह विशिष्ट जन्तु अपनी अतिविशिष्ट सुगन्ध एवं औषधीय गुणों के कारण विशेष महत्व रखता है, आयुर्वेदीय और युनानी औषधियों एवं चिकित्सा के क्षेत्र तथा सौन्दर्य प्रसाधन उद्योगों में कस्तूरी की बढ़ती मांग के कारण चोरी छिपे अवैधानिक आखेट होते रहने से इस मृग का वंश क्षीण होता जा रहा है जो कि अत्यन्त चिन्ताजनक है। कस्तूरी मृग की मुख्यतः पाँच प्रजातियाँ हैं जो कि भिन्न-भिन्न पर्यावरण के अनुकूल विभाजित हैं। इनमें से मुख्यतः (1) हिमालयन मॅस्कडीयर (मॉशकस माश्चीफेरश), (2) एल्पाइन मॅस्कडीयर (मॉशकस फ्राइसोगेस्टर फ्राइसोगेस्टर), (3) ब्लैक मस्कडीयर (मॉशकस फ्यूकस) (4) फारेस्ट मॉस्कडीयर (मॉस्कस वेरीजोस्की) तथा टैगा साइबेरियन मॅस्कडीयर (मॉशकस माश्चीफेरस) मुख्य हैं। “कस्तूरी मृग” पर्वतीय क्षेत्रों में बर्मा, तिब्बत, चीन, नेपाल, पाकिस्तान तथा भारत में सिक्किम एवं अरुणाचल प्रदेश के हिमालय, किश्तवाड़ (जम्मू कश्मीर), उत्तरांचल प्रदेश के गढ़वाल कुमाऊँ हिमालय एवं हिमाचल प्रदेश के पर्वतीय क्षेत्रों में पाया जाता है।

प्राकृतिक आवास

“कस्तूरी मृग” (माश्कस माश्चीफेरश हिमालयन) को उसके प्राकृतिक आवास में प्रायः बुग्यालों में हरी घास के मैदानों और सघन वन व चट्टानों वाले स्थानों तथा झाड़ियों के मिलान वाले क्षेत्रों में विचरण करते देखा जा सकता है। प्राकृतिक आवास में ये 3-4 प्रतिवर्ग किलोमीटर के घनत्व में रहते हैं। बुग्यालों का उन्मुक्त वातावरण इन्हें अत्यन्त प्रिय लगता है। हिमपात होने पर प्रायः ये निचले स्थानों पर आ जाते हैं जहाँ पर खर्सू, मोरु आदि के घने वृक्ष या झाड़ियों के बीच अपना आवास बना लेते हैं। हिमपात समाप्त होने के पश्चात् पुनः अपने पूर्व आवास स्थल को लौट जाते हैं।

“कस्तूरी मृग” प्रायः रात्रिचर होता है। रात्रि में इसे कभी आराम करते तथा कभी चरते हुये देखा जा सकता है। लेकिन यह जन्तु सुबह एवं शाम को भी अपने भोजन की खोज में निकलते हैं। प्राकृतिक भोजन के तौर पर मुख्यतः ये बान्ज प्रजातियों, सीमारु (रोडोडेन्ड्रोन कम्पैन्यूलेटम), कस्तूरी चारा (स्कीमिया लौरेला) की पत्तियाँ तथा वुरांश (रोडोडेन्ड्रान स्पीसीज) के

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** रीडर, प्राणी विज्ञान विभाग, डी. बी. एस. महाविद्यालय, देहरादून।

पुष्पों को खाते हैं। एल्पाइन शैवालों में भी इस वंश के मृग की अधिक रूचि दिखाई देती है। इनमें मुख्यतः यह उसनिया प्रजाति के शैवाल, कुकुरमुत्ता (अगेरिकस स्पेसीज) का सेवन करते हैं। प्राकृतिक चुगान में मुख्यतौर पर दूब घास (साइनोडोन डेक्टाइलन) को ही चुगते देखा जा सकता है।

शारीरिक संरचना

“कस्तूरी मृग” सभी वन्य मृगों की तुलना में आकार में छोटा होता है। इस वंश में नर तथा मादा में लगभग समानता होती है। इनमें सींग नहीं होते, जिनकी अनुपस्थिति का लाभ इन्हें शत्रुओं के डर से झाड़ियों एवं गुफाओं में छिपने में सहायता करता है। नर मृग के ऊपरी जबड़े की दोनों कालों से एक एक कनाइन दाँत निकले होते हैं। मादा में कैलाइन दाँत अन्य दाँतों की तरह सामान्य होते हैं। पूँछ छोटी होने से इसका अंदाला नहीं लगाया जाता कि इस जन्तु में पूँछ है कि नहीं। “कस्तूरी मृग” की मुख्य विशेषता इसकी “कस्तूरी ग्रन्थि” है जो कि केवल नर मृग में ही पायी जाती है। इसका प्रमुख स्थान नर मृग के पेट के बाहर, बालों वाली खाल के भीतर दो पतली झिल्लियों से बनी लगभग गोलाकार थैली में नाभि के पास होती है। एक वर्ष की आयु के पश्चात् धीरे धीरे कस्तूरी बनने की प्रक्रिया शुरू होती है। “कस्तूरी ग्रन्थि” के थोड़ी सी दूरी पर एक बारीक सुराख रहता है। “कस्तूरी” निर्माण के दौरान मृग में विभिन्न प्रकार के परिवर्तन आते हैं। सर्वप्रथम यहाँ एक दूधिया पदार्थ का श्राव होता है। जो कि धीरे धीरे कठोर होता जाता है। यह प्रक्रिया वर्ष में दो बार होती है। इस दौरान पेशाब वाले स्थान पर “कस्तूरी” की गंध प्रतीत होती है। एक बार में लगभग 20 से 40 ग्राम कस्तूरी एक मृग से प्राप्त की जा सकती है। अनुमानतः लगभग 50-100 नर मृगों को मारकर 1 किग्रा. कस्तूरी प्राप्त की जा सकती है।

इस जन्तु का व्यवहार

“कस्तूरी मृग” अधिकतर एकान्तप्रिय होता है। यह अत्यधिक चंचल व साथ-साथ डरपोक भी होता है। परिचित लोगों तथा अन्य जानवरों के देखकर कुछ भयभीत सा रहता है। अपने साथ अन्य जानवरों की मौजूदगी बर्दाश्त नहीं कर सकता, यहाँ तक कि नर मृग 6-7 महीने का होने पर अपनी माँ पर भी झपटना शुरू कर देता है। ये जन्तु स्वच्छता प्रिय होते हैं। मलत्याग एक नियत स्थान पर करते हैं। एक स्थान से दूसरे स्थान पर जाने में भी ये जन्तु मल त्याग या मूत्रत्याग उसी स्थान पर करते हैं जिस स्थान पर पहले से ही दूसरे जन्तुओं के मल एवं मूत्रत्याग का स्थान हो। कस्तूरी जन्तु पानी कम पीते हैं। ग्रीष्म ऋतु में भी पानी का अधिक सेवन नहीं करते। मौसम सुहावना होने पर ये खुले वातावरण में उछलकूद करना आरम्भ कर देते हैं।

कस्तूरी मृग में प्रजनन

प्रजनन केवल जाड़े की ऋतु में होता है। दिसम्बर या जनवरी के अन्त तक गर्भधारण करने की प्रक्रिया जारी रहती है। गर्भावस्था लगभग छः महीने की होती है। मादा की प्रमुख विशेषता

यह है कि वह स्वयं ही नर की खोज करती है। एक समय में मादा एक ही शावक को जन्म देती है। लेकिन यदाकदा दो को भी जन्म देते देखा गया है।

वन्य संरक्षण अधिनियम

1971-72 में "वन्य जन्तु संरक्षण अधिनियम" के तहत "कस्तूरी मृग" के वंश को विलुप्ति से बचाने के लिए इस मृग को "ए" श्रेणी का प्राणी घोषित किया गया है। इस नियम के तहत इन जन्तुओं को मारना, पकड़ना, बेचना, पालना और इनकी "कस्तूरी", खाल, बाल, मांश, दाँत, खुर्र हड्डियाँ इत्यादि अपने पास रखना या बेचना दण्डनीय अपराध घोषित किया गया है। परियोजना के प्रारम्भिक वर्षों से (वर्ष 1971-72 तथा 1974-75) हाल के वर्षों में 'कस्तूरी मृग' की संख्या में कोई वृद्धि नहीं हुयी है। जबकि सरकार इनके संरक्षण के लिए हर वर्ष विशेष 'प्रोजेक्ट्स' तथा करोड़ों रुपये व्यय करती है। 'कस्तूरी' की अत्यधिक बढ़ती हुयी मांग, चिकित्सा एवं अतिरिक्त सौन्दर्य प्रसाधन उद्योगों में निरन्तर उपयोग में लाने से इस मृग का चोरी छिपे आखेट होना इसके विलुप्तीकरण का संकेत दे रही है।

निष्कर्ष

प्रस्तुत लेख का प्रमुख उद्देश्य "कस्तूरी मृग" के विलुप्तीकरण पर प्रकाश डालना है। इस वंश के मृगों की संख्या में निरन्तर कमी इस बात का प्रमाण है कि चोरी छिपे तथा अवैधानिक आखेट होना, शासन-प्रशासन एवं वन्य विभाग की घोर उदासीनता का होना है। कानूनी नियमों को ताक पर रखते हुए स्थानीय लोगों द्वारा आज भी अंधाधुंध शिकार किया जाता है। औषधियों एवं सौन्दर्य प्रसाधनों की बढ़ती हुयी मांग ने "कस्तूरी" की कीमत को आसमान पर पहुँचा दिया है जिससे लोभ में आकर लोग इनका निरन्तर संहार करते जा रहे हैं, इस वंश को विलुप्ति से बचाने के लिए इन पर निरन्तर शोध कार्य होने तथा मृग को विना क्षति पहुँचाये वैज्ञानिक तरीके से 'कस्तूरी' निकालने की प्रक्रिया पर ध्यान देना आवश्यक है। जिन-जिन स्थानों पर कस्तूरी मृग को संरक्षण दिया जा रहा हो वहाँ पर शासन प्रशासन तथा वन विभाग द्वारा जन साधारण में जागृति पैदा की जाये। इस दिशा में चल रहे शोध कार्यों में विशेष ध्यान दिया जाये एवं समय समय पर इनकी रिपोर्ट मांगी जाय। जिससे चोरी छिपे होने वाले मृग संहार जिसमें कि वनकर्मियों एवं राजस्व पुलिस की भी पूर्ण भागीदारी होती है, दुर्लभ प्रजाति को बचाया जा सके। कानूनी तौर पर उन लोगों से सख्ती से निपटा जाय जो इस जन्तु के संरक्षण समबन्धी नियमों को तोड़ने की कोशिश करते हैं। अगर इस मृग के वंश का संहार होने से नहीं बचाया गया तो आने वाली पीढ़ी के लिए यह मात्र जीवाश्म बन कर रह जायेगा। किन्तु अगर इस दुर्लभ जन्तु को पूर्ण संरक्षण मिल सकेगा तो हमारी प्राकृतिक सुन्दरता में निखार आयेगा जिसका दृश्य हर किसी को अपनी ओर आकृष्ट करने में सक्षम होगा।

“संयुक्त वन्यजीव संरक्षित क्षेत्र प्रबन्धन”*

लेखक— डॉ० आर. बी. एस. कुशवाह** एवं श्री देवेश कोहली***, भा. व. से.

विस्तृत सारांश (Extended Summary)

वन्यजीव संरक्षित क्षेत्रों में भी वन क्षेत्रों की भांति जन भागीदारी से प्रबन्धन कार्य आज हमारे देश में ही नहीं अपितु सम्पूर्ण विश्व में किया जा रहा है। संयुक्त वन प्रबन्धन की ही भांति वन्यजीव संरक्षित क्षेत्र प्रबन्धन में स्थानीय जनता की सक्रिय भागीदारी प्रबन्धन योजना बनाने व उसके क्रियान्वयन में सुनिश्चित की जाती है। अन्तर्राष्ट्रीय स्तर पर विश्व संरक्षण संघ IUCN द्वारा छः प्रकार के वन्यजीव संरक्षित क्षेत्र (PAs) वर्गीकृत किये गये हैं, जो इन क्षेत्रों में परमिटेड मानव उपयोग (बढ़ते क्रम) में इस प्रकार हैं— स्ट्रिक्ट नेचर रिजर्व, राष्ट्रीय उद्यान, प्राकृतिक मोन्यूमेन्ट्स प्राकृतिक लेण्डस्केप्स, प्राकृतवास/प्रजाति प्रबन्धन क्षेत्र, संरक्षित लेण्डस्केप्स/सी-स्केप्स एवं मेनेज्ड रिसोर्स प्रोटेक्टेड एरियाज। इसके अतिरिक्त बायोस्फेयर रिजर्व तथा वर्ल्ड हेरीटेज साइट्स दो अन्तर्राष्ट्रीय डेजिग्नेशन्स भी हैं। हाल ही में वर्ष 1999 में सतपुड़ा बायोस्फेयर रिजर्व की स्थापना मध्यप्रदेश राज्य में की गई है जिसमें सतपुड़ा राष्ट्रीय उद्यान, बोरी एवं पचमढ़ी वन्यजीव अभ्यारण्यों के वन्यजीव क्षेत्रों को शामिल किया गया है।

प्राकृतिक संसाधनों के प्रति जन-मानस में जब स्वामित्व की भावना पुष्ट होती है तो वे स्वयं ही इन संसाधनों के प्रबन्धन हेतु आगे आते हैं। अतः वन एवं वन्यजीव क्षेत्रों के प्रबन्धन हेतु जन-भागीदारी प्रबन्धन सफलता का सूचकांक हो सकता है जो अन्तर्राष्ट्रीय स्तर पर स्वीकार किया गया है। भारत सरकार ने भी इसी प्रयोजन हेतु 1990 में अधिसूचना व निर्देश जारी किये जिसके अनुसार मध्यप्रदेश शासन द्वारा भी JFM व JPAM क्रियान्वयन प्रबन्धन हेतु निर्धारण कर राष्ट्रीय वन नीति 1988 के परिपेक्ष्य में निर्देश जारी किये गए। आज देश के लगभग सारे राज्यों व केन्द्र शासित प्रदेशों में ग्राम वन समितियों व वनसुरक्षा समितियों के माध्यम से वन एवं वन्यजीव संरक्षित क्षेत्रों का प्रबन्धन कार्य प्रगति पर है। इनमें जन साधरण की सक्रिय भागीदारी प्रबन्धन योजना बनाने से लेकर प्रबन्धन प्रावधानों के क्रियान्वयन तक

* उक्त शोधपत्र शहडोल वृत्त, शहडोल में आयोजित वृत्तस्तरीय “संयुक्त वन प्रबन्धन”

कार्यशाला दि० 27.01.2000 में पढ़ा गया तथा इस पर गंभीर चर्चा हुई।

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सुनिश्चित होने के कारण निश्चित रूप से इन क्षेत्रों के अपार प्राकृतिक संसाधनों के संरक्षण को सुनिश्चित कर दिया गया है। इसमें PRA तकनीक का उपयोग ग्रामीण संसाधनों की स्थानीय स्थितियों/दशाओं जैसे— भूमि, जल, वन, वन्यजीव, ग्राम के संसाधनों की वर्तमान स्थिति, वनवासियों का सामाजिक-आर्थिक विश्लेषण व आकलन किया जाता है। इनका वर्तमान स्थिति में आकलन (PRA) तकनीकी से करने पर इन्हें भविष्य में इम्पूव करने का मार्ग प्रशस्त हो जाता है, क्योंकि जन भागीदारी से इन संसाधनों का आकलन वास्तविक रूप में मौके पर किया जाता है, तथा योजना (इन्हें इम्पूव करने की) भी जन भागीदारी से ही बनाई जाती है तथा इस योजना का क्रियान्वयन भी विभिन्न विभागों के समन्वय से किया जाता है। इन सभी स्तरों पर जन-भागीदारी सुनिश्चित रहती है। इससे जन साधारण, स्थानीय लोग स्वयं अपने क्षेत्रों की समस्याओं का आकलन कर उनका समाधान सुझाते हैं तथा प्राथमिकताएं तय करते हैं जिससे उनकी पारंपरिक बुद्धिमत्ता, स्किल व ज्ञान का लाभ प्रबंधन समिति को मिलता है। इससे इन कार्यक्रमों का उचित क्रियान्वयन प्राथमिकताओं के अनुरूप द्वाएबल रूप से सुनिश्चित हो जाता है। प्राचीन काल से कई हजार वर्षों का अर्जित ज्ञान व अनुभव का निचोड़ जो ग्रामीण जनता व वनवासी प्राप्त करते रहे हैं उसका पूरा उपयोग इनमें प्राप्त होता है साथ ही उनमें दायित्व बोध भी सुदृढ़ होता है। PRA से प्राप्त जानकारी व आंकड़े लोगों के अपने विश्लेषण द्वारा प्राप्त किए जाने से इन विश्लेषणों से प्राकृतिक रूप से निकाले गए निष्कर्ष मात्र किताबी ही नहीं व्यावहारिक होते हैं जिनसे प्रबंधन योजना व इसका क्रियान्वयन भी उचित रूप से एकीकृत समन्वय भाव व उपाय द्वारा करने में कठिनाई न्यूनतम आती है।

मध्यप्रदेश शासन द्वारा संयुक्त वन एवं वन्यजीव क्षेत्रों के उचित प्रबंधन को सुदृढ़ करने हेतु कई उपाय किए गए हैं जिससे शासन स्तर से इन कार्यक्रमों में आने वाली कठिनाइयों का निराकरण होने के साथ ही इनकी सफलता के नए आयाम खुल गए हैं।

कई उपाय इन कार्यक्रमों की सफलता हेतु सावधानी पूर्वक स्थानीय संसाधनों व कठिनाइयों के परिपेक्ष्य में किए जाने की आवश्यकता है।

- * समाजिक-राजनैतिक-आर्थिक, पर्यावरण, इकोलॉजिकल व संस्थानों के सक्रिय समर्थन का अभाव, विधिक फ्रेमवर्क का अभाव आदि।
- * JPAM के सम्बन्ध में पर्याप्त नीतियां व कानून बनाने सम्बन्ध कार्य, उपभोक्ताओं की सही पहचान, लचीलापन, समआर्थिक कंसीडरेशन्स, कार्यक्षेत्र से फीडबैक आदि से टैकल किए जा सकते हैं।

- * स्थानीय लोगों को दिए गए अधिकार एवं रियायतों को उचित प्रकार से कंसीडर किया जाना चाहिये। MOPRO शासन द्वारा इस बिन्दु पर कई उपाय जैसे निस्तार सुविधाओं में संशोधन, परिवहन अनुज्ञा नियमों में संशोधन आदि किए गए हैं।
- * JPAM के सभी पार्टनर्स की ज्ञान वृद्धि हेतु क्षमता-निर्माण कार्यक्रम तैयार किये जाने चाहिए।
- * वन एवं वन्यजीव संरक्षित क्षेत्रों के एकीकृत सम्पूर्ण विकास हेतु इंस्टीट्यूशनल स्ट्रक्चर्स को इम्पूव करना आवश्यक है, जिसमें स्थानीय समुदायों की सामाजिक व आर्थिक आवश्यकताओं को शामिल किया गया हो।
- * JPAM में बाहरी कारकों व प्रतिष्ठित गैर शासकीय संस्थानों के रोल को स्पष्ट रूप से क्लासीफाई व परिभाषित करना। व्यक्तिगत लोग व अशासकीय संस्थानों द्वारा अभी तक इस संबंध में किए गए, किये जा रहे व किये जाने वाले कार्यों का स्पष्ट वर्गीकरण व परिभाषित करना आवश्यक है।

(अ) फारेस्ट जोनेशन कंसेप्ट— विभिन्न जोन को स्पष्ट रूप से डिमार्कट किया जाए।

जोन-1 वन्य जीव संरक्षित क्षेत्र.

जोन-2 वन्य जीवन संरक्षित क्षेत्रों के बाहर उनसे लगा क्लोज्ड वन क्षेत्र.

जोन-3 खुला वन क्षेत्र.

जोन-4 प्राइवेट व सामुदायिक वन.

(ब) प्रत्येक जोन हेतु पृथक से उद्देश्य व रणनीतियां तैयार कर लागू की जाएं।

जोन-1 इनमें राष्ट्रीय व अन्तर्राष्ट्रीय समन्वय से मानव व संस्थागत क्षमताओं एवं उनके ज्ञान का पूर्ण उपयोग करने हेतु संरक्षण एप्रोच.

जोन-2 क्षेत्रों में वनावरण का रखरखाव, ग्राइंग स्टाक का एनरिचमेंट, काष्ठ व गैर काष्ठीय उत्पादन.

जोन-3 क्षेत्रों में वनावरण को बढ़ाना, बिगड़े वनों का सुधार, स्थानीय समुदायों की आवश्यकताओं के अनुरूप वनोपज का उत्पादन.

News & Views

1. India's tiger population declining, says UN report – Anjali Mody London, April 4

INDIA'S tiger population was declining and could be wiped out in 10 years, according to the authors of a UN report into the status of the tigers in 14 Asian countries. Rob Hepworth, a British civil servant and co-author of the report said: "we believe the rate of decline of India's tiger population is accelerating and is now close to being in free-fall." He said that the actual tiger population in India was much lower than the official 5,000 and put the figure at between 2000 and 3000.

The report part of a year-long inquiry by the UN Convention of international Trade in Endangered Species (Cites), Tiger Mission, says "the mission was not convinced that (Indian) tigers outside designated protected areas, or indeed those inside other than showcase reserves, were being properly protected or valued." It called for international donors to stop funding tiger conservation in India "until Central and State Governments demonstrated that such money would be spent, effectively, in total, and where they were needed."

The report said that "apathy, complacency and bureaucracy" competition rather than co-operation between Government departments, corruption at all levels and a "culture of cover-up were the chief problems." It said that the Government officials deliberately concealed the number of tigers killed by poachers, and inflated tiger census figures. The report said that India had failed to promote eco-tourism, target its revenues towards conservation, or to involve local communities leaving them "easy prey for the organized gangs who may pay them to poach tigers".

According to the report, poaching was profitable, well-organised and on the rise. The inquiry team was told about a seizure made by the police in which they recovered 120 leopard skins, seven tiger skins, 185 kg of tiger bones, more than 100 tiger claws and 18,000 leopard claws. The report said that the scale of the seizure, which shocked even Indian officials, was a clear indication of the role of an "organised crime network."

Another indication of this, the report said, was the fact that poachers were rarely jailed and even repeat offenders were regularly granted bail. It said "the manner in which arrested poachers... were regularly supported by experienced and well-staffed legal defence teams, out of all proportion with what such individuals might be expected to afford, provides further grounds to suggest the presence of organised criminal networks."

The CITES report said that while the 'showcase' reserves – like Ranthambhore— has well armed forest guards and appeared to be using new off road vehicles, guards, some of them elderly, at the far less visited reserves like Panna had no vehicles or weapons. The report says the inquiry team was "firmly of the opinion that such personnel could not properly protect themselves, let alone protect the tigers in the reserves."

It said that the fact that basic essentials like radio equipment, modern weapons and vehicles were still not available to guards— some of whom have not been paid for 21 months— was regrettable especially since between \$8-10 million of international assistance and \$130-150 million of Indian Government funds have been poured into tiger conservation in the last 27 years.

2. Gir's lion population has risen since '95— Parag Dave, Rajkot, June 29

OWING to the cancellation of the planned lion census from May 17 to 23 due to unseasonal rains, the Forest Department conducted a "beat survey" last week to get a rough estimate of the number of lions in their only abode in Asia—Sasan Gir.

Sources say the survey revealed that there are around 320-330 lions in the Gir forest-up from the last count of 304 in 1995. Junagadh District Forest Conservator, Kupdeep Goel admitted a beat survey had been conducted but said it was an internal matter of the Department and refused to confirm the figures.

The lion census has been dogged by controversy for some time now. Conducted every five years, it was due in May 2000. The Department had planned to conduct a water-hole census and use the bait method to get the exact number of lions in Gir. However, a High Court decision ordered it not to

use the method. This was a set back compounded by the unseasonal rains that lashed the forest on the second day of the survey, making a water-hole survey impossible.

However, the Department decided to get a rough figure of lions by using the beat survey method on June 21, 22 and 23. Accordingly the forest was divided into more than 60 beats of 500 square yards each.

3. Carcasses of dolphins spotted in Orissa—Times of India, 14.9.2000

KENDRAPARA: Carcasses of seven Gangetic dolphins were recently spotted near Satbhaya village near the Gahirmatha beach in Kendrapara district, according to a group of activists of an NGO working for wildlife protection.

Randhir Jena, secretary of the Cell for Environment Protection (CEP) said here on Wednesday that the majestic creatures could have died after being hit by the propellers of fishing trawlers which intruded into the coastal waters, now declared a marine sanctuary, frequently or by getting caught in the fishing nets of the vessels.

It appeared the dolphins had been washed ashore recently. Jena said. The river system around the nearby Bhitarkanika wildlife sanctuary is considered an ideal habitat for these aquatic species.

Five dead dolphins had been found on the Gahirmatha beach, famous as the world's largest rookery for the Olive Ridley sea turtles, earlier this year.

The Gangetic dolphin, zoologically known as *Platansita gangetica*, is a protected species, belonging to Schedule 1 of the endangered list. It is also protected under the Wildlife Protection Act.

These animals are not killed for meat or oil in Orissa since traditional fishermen consider them sacred, he said. (PTI)

Know Your Wildlife

King Cobra

Out of nearly 2700 species of snakes only one-fourth are poisonous. Among the poisonous snakes King Cobra (*Naja naja*) is the deadliest one. One time emission (500 mg) of venom by a king cobra is capable of killing 160 persons or an adult elephant. A man bitten by king cobra, if left untreated, will die in two to six hours. It bites the prey animals, such as, mice, rabbits, frogs etc., paralyses them with its poison in seconds and then swallows from the head.

King Cobra (*Naja naja*) is found almost in every continent except North Arctic and South Antarctic regions. It has been found in Himalayas up to 10,000 feet.

A fully grown king cobra acquires a length of 7 feet in India. But in Africa and Australia king cobra measuring 12 to 18 feet have been seen. Ironically king cobra weighs much less given for its length. A fully grown king cobra weighs about 5 kgs. It can be identified with a well marked hood. The hood sometimes bears spectacle marks.

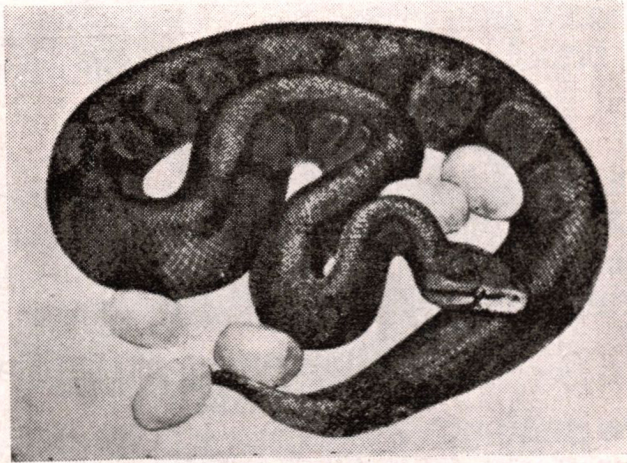
King cobra prefers to dwell in a jungle environment, with heavy rainfall and thick forest floor. It is very active and is remarkably agile. King cobra is aggressive in nature and makes advances towards its intruder. It moves very fast, can jump over considerable distances and can swim in water. When confronted with man or predator, it rises up, sometimes more than a metre, hisses and blows hell of lot to advertise its presence. These warnings are not mere bluffs and mind you, the cobra often bites. They take 10,000 lives every year in India alone.

King cobra is the only snake which makes its nest from twigs and grass litter for laying eggs. The mother guards the eggs and when the young ones are about to hatch, the mother cobra quietly leaves the nesting site. Since cobra mainly feeds on snakes the mother does not want to stay at nesting site to eat its own progeny.

King cobras are rare animals (reptiles) and it has been declared as endangered species under the Wildlife (Protection) Act of 1972.



(King Cobra (*Naja naja*))



Python (*Python molurus*).

Python

Python (*Python molurus*) is a non-poisonous snake. In vernacular it is called Ajar. Python is found throughout India, particularly in rocky wet regions with bushes. Outside India it is found in Africa, South-east Asia and Australia.

Indian python is huge massive snake. It is 8'-16' long but sometimes reaches a length of 20'. In Africa, Malaysia and Philippines pythons attain a length of 28' and girth of 2'. A full grown python weighs about a quintal.

Python prefers remaining near water and can remain submerged for nearly half an hour. In Shiwalik and Bhabar areas of Uttar Pradesh it thrives remarkably well under perfect dry conditions. It is a good climber and can hang from a tree branch by its tail while suspending its body.

Python is lethargic and does not make much efforts to catch its prey but lets the prey come to its proximity and then suddenly becomes very active, hurling its head at the body of the prey, grab it and strangulating and squeezing the victim with the coils of its strong muscular body. After the death of the prey it is gradually shoved inside the mouth, which can open wide, so as to swallow a full grown sambar. It has been known to eat a full grown leopard. Python generally feeds on mammals and birds. Man is rarely attacked unless provoked.

Python hibernates for several months in winter especially in colder regions such as North India. Mating also takes place during winter. Female lays in shallow nest. As many as 100 eggs are laid. The mother coils round the nest and hatches the eggs for two months, during which period it remains without food. The eggs hatch out in 60 days. The babies are about 2½' long at the time of hatching and grow rapidly. In one year they attain a length of 6½' and in two years 9'-10'.

Indian python is docile in captivity. One can see python sleeping with the children or hanging around the neck of **Madaries**.

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Python is lethargic and does not make much effort to catch its prey. The prey come to its proximity and then suddenly becomes very furious its head at the bottom of the prey, grip it and strangulate squeezing the victim with the coils of its strong muscular body. After the prey it is gradually shoved inside the mouth, which can open wide as to swallow a full grown sambar. It has been known to eat a full leopard. Python generally feeds on mammals and birds. Man is attacked unless provoked.

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Indian python is docile in captivity. One can see python sleeping with children or hanging around the neck of Madhava.

Wildlife Preservation Society of India

1. The aims and objects of the Society are as follows :-

- (a) To promote interest and impart knowledge regarding the preservation and conservation of all forms of wildlife, particularly among the youth of the country.
- (b) To cooperate with the Govt. of India and State Governments and with others Societies and Institutions having similar aims and objects in working for the interests of wildlife.
- (c) To assist in enforcing and actively supporting the Forests Acts, Wild Birds and animals Protections Acts and Rules etc. of State Governments and the Indian Arms Act and Rules in so far as they pertain to wildlife and to bring to the notice of the authorities any infringement of the same and to assist in the detention and prosecution of offenders in respect of such laws.
- (d) To advise and help the Govt. and wildlife administrators in the formation, maintenance and protection of Sanctuaries and National Parks, preservation of wildlife in general and endangered species of India in particular and in the introduction of exotic species into the country, rehabilitation of endangered species etc. and in the formulation and amendments of rules and acts, so as to conserve and increase wildlife stocks.
- (e) To raise funds for carrying out the above aims and objects and to found and maintain museums, reading rooms and libraries of natural history in order to disseminate knowledge regarding wildlife.
- (f) To carry out publicity and propaganda for the preservation of wildlife in India by means of monographs, journals, films, filmstrips and other feasible methods.
- (g) To assist members of the Society in obtaining facilities for viewing and photographing wildlife in India.
- (h) To conduct research into the problem of Wildlife management in India, and in pursuance of this, to initiate, encourage and, where possible assist in the projects for the study of threatened species and related objects and to provide reference and research facilities for such work.
- (i) To carry on such other activities which will serve the above subjects.

2. What membership of Wildlife Preservation Society of India will entitle you to?

- (1) You will become an active member of the growing group of Wildlife enthusiasts, who enjoy working for and spreading the knowledge of how to conserve India's heritage of wildlife for posterity.
- (2) You will be entitled to the full use of the library of the Wildlife Preservation Society and of its reading room.
- (3) You will receive a membership certificate.
- (4) You will receive a personal Identification and Membership Card.
- (5) You will be entitled to buy all publications of the Society at a concessional rate.
- (6) You will be entitled to buy at concessional rates the Societies Greeting Cards, Calendars, Tie, Lapel badges and the Balance of Nature Game (specially. Published in colour for its educative and recreational values).
- (7) You will be supplied "Cheetal", the quarterly journal of the society free.

3. For membership particulars write to Honorary Secretary, Wildlife Preservation Society of India, 7 Astley Hall, Dehra Dun.

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